THE

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ELECTRICAL REVIEW.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NATIONAL FACTORIES: THEIR UTILISATION FOR ELECTRICAL INDUSTRIES.

Now that a halt has been called in the march of munition production, the nation will be left with a number of large factories for which it has no further need. In a few cases it is possible that the Government may decide to retain these for their original purpose, as sections of that national arsenal with which even a successful League of Nations cannot entirely dispense.

The majority of the national factories, however, must be converted to industrial uses, whether under national or private control; and it has already been announced that the Ministry of Munitions is open to receive, from commercial and manufacturing concerns, offers for such factories, or parts thereof.

What is the general position as regards their suitability for electrical trades (which must develop rapidly in the next few months if we are to obtain the power to supply our share of the world's output of such goods)? The factories themselves vary much, as is inevitable when it is remembered that some dealt with the manufacture of one type of explosive and some with that of another, that some dealt with the filling of large shells and some with the filling of small fuses, or of detonators, and others dealt with matters even more diverse. Further, they were designed in some cases by H.M. Office of Works, in others by a firm acting as agent, in others by local committees, and, in one case, at any rate, by an individual.

Amongst the diversity of types there are several which may be regarded as useless for our purpose, consisting, as they do, merely of a number of small buildings separated from each other by considerable distances, the buildings themselves being often of the flimsiest construction, and communicating with each other by nothing more substantial than wooden footways. Such factories can only be handed over to the salvage men for dismantling and for the recovery of the valuable materials of which they are constructed and the plant with which they are equipped.

There are, nevertheless, many points which will strongly recommend many of the factories to prospective purchasers. In all cases first-class internal railroads of standard gauge have been laid down; internal water supplies, sewage arrangements, fire-hydrant services, &c., are complete; the buildings are ready for use, are well lighted and heated, frequently provided with hydraulic power, electric power, and sometimes gas; housing and canteen accommodation are usually connected with the factories; and there is always room to expand. All these are good points when one is factory-hunting.

To pass from the general to the particular, a Western factory comes to mind—in itself not the most suitable for many purposes, but still not such a one as was referred to

as being doomed to demolition—where there is one group of four buildings, each about 120 ft. by 110 ft., and an adjacent group of eight buildings, each of which is some 180 ft. by 120 ft., separated from each other by less than 100 yards. The arrangement may not be ideal, but it is by no means impossible.

There is a case at a Midland engineering town where one section of the factory comprises four groups of eight communicating shops, each of them 100 ft. long by 50 ft. wide, standing in one cluster of 32 shops, separated by less than 10-yard spaces. These surely constitute a fine factory for electrical manufactures, having good north lights by day and brilliant electric ones by night, being fitted with racks and centre tables in most cases, with motors and shafting in many, and with hydraulic power in a few. Surrounding buildings provide storage or supplementary workshops; there are steam boilers and hot-water boilers, with a 120-ft. brick shaft and the usual good railway provision—within sight of a colliery, moreover.

Turn to another—this time in the North-West of England. Here we have two substantial buildings adjoining one another; the one of 68,000 sq. ft., the other of 42,000—a total floor area under continuous roofing of approximately 110,000 sq. ft., and equipped with 10 or 12 electric overhead travelling cranes for loads of 2 tons. Nor is this all; for within a few hundred yards are further buildings, fitted with similar cranes—two of 6,000, four of 12,000, and two of 17,000 sq. ft. floor space—truly, a property of very valuable possibilities. The engineering industry must be very fast asleep if such a factory remain for long unused.

These examples represent three distinct types of factory, each deserving the attention of our leaders of constructional industry. There are many other types from which to choose, varying in locality, design, conveniences, and, presumably, cost. Inquiry should produce something to suit most cases.

Instances might be multiplied. Possibly in the course of time the Ministry of Munitions may advertise their properties and schedule their proportions; but live firms will speak now and act to-day. Electrical engineering is not the only industry which is seeking premises for extending existing activities and inaugurating new ones. Some of the national factories may hang fire for a long time (for they are not counted merely by dozens), but the *best* will soon be spoken for, and it behoves us to get in first.

British Manufacturing in Peace and War.

Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, delivered two speeches in London, last week. In one he referred to some of the benefits that accrued to British industry from the demands arising out of the war. The terrible tests of the emergencies to which we were exposed, especially in the earlier stages of the conflict, revealed weaknesses in regard to organisation, works' equipment, material, and so forth, which it was necessary to remove in order to arrive at a certain efficiency in production unrealisable under normal conditions. What the speaker had to say concerning mica was one of the strongest arguments that could be used for the proper utilisation of British Empire resources. The Empire is very strong as regards natural *possession* of mica as a raw material, for 50 per cent. of the world's supply is produced in India and 15 per cent. comes from Canada. But the mere existence of the material in British territory is of little avail to us industrially if we permit German interests to secure such a measure of control as to take the material to Germany to be worked up, instead of coming here to provide work for the British electrical industry. We trust that our legislators, as well as industrial and financial authorities, will profit by this experience in shaping their future course of action. But mica is only one of many lines in which the nation has been advantaged by its war-industrial necessities and efforts. The tungsten industry, the manufacture of ferro-chrome for steel production, spelter, potash, magnetos and other ignition devices, optical and scientific instruments—all of these came in for mention. The improvement of works' methods, the advantages of repetition work, the use of electric trucks in factories—indeed, the more reasonable use of the most suitable equipment and the full utilisation of scientific knowledge—have brought us through our period of stress and strain in such a way that to-day we stand, in the opinion of Mr. Kellaway, "first in the world in almost every sphere of industrial effort." It is surely up to all of us to see that there is no falling from this pinnacle of grace in the days when the menace of war does not confront us and when the tendency to become preoccupied with internal political problems may put us in danger of forgetting the lessons that have been learned at so great a cost.

The other speech delivered by Mr. Kellaway was concerned with what our works are doing to change over from munitions and war productions to commercial manufacturing. While it is true that the vastness of our war effort has been responsible for the greatness of the difficulty that now confronts us as we are proceeding with the transformation from war to peace operations, it is also true that the advances made under war conditions will, in many respects, materially help us in that transformation process. The account that the speaker gave of some of the peace-time articles that are to be turned out by works lately making war productions was entertaining. We have already mentioned a number of such changes arranged for in well-known works. Mr. Kellaway, with the information officially at his disposal, was able to go much further. He instanced aeroplane factories which were turning over to toy and furniture production; gun factories changing over to the building of locomotives—a line in which we had abundant scope, and might have done better had less of our railway building been done by the railway companies themselves; fuse factories turning over to the making of electric fittings. Others are to produce files and springs in place of shells; dairy utensils instead of steel pressing for mines and copper bands for shells; valves instead of aeroplane assembling; motor accessories and capstan lathes in place of fuse and aeroplane parts. These are only a few of the articles he mentioned, and those he mentioned were but a small portion of the whole of the changes which are being proceeded with in the hope of giving employment to hundreds of thousands of British workpeople, the utilisation of British-Empire material, and the stoppage of importation of German manufactures, which, under the altered conditions resulting from the war, we may find ourselves well able to dispense with. Of course, nobody expects all these factories to settle down to their new operations at once. In many cases arrangements have been made for the installation of special equipment, and if the needed "pivotal" men are expeditiously released from the Forces, and materials are available, there should be good progress made in the course of a few months. For a time the demand for most lines of manufacture will be very heavy, but increased production, which is to earn high wages, will call for an extended market for years to come. We are aware that the world is hungering for manufactured products, notwithstanding war-time efforts of some nations which have not been so deeply involved in the war as we have. We require to lay ourselves out enterprisingly to satisfy that hunger, and one way of doing so is to adopt an intensive export policy, and carry it out through subsidiary companies, branches, and agents, and through the medium of the regular and many-channelled weekly service of trade journals. These last have proved their utility for maintaining export trade reputations and connections in many parts of the world under the restrictions imposed upon them and their foreign circulations by the authorities during the war, and now that a period of greater freedom is at hand, they will play a more responsible part than they have ever done before in bringing orders to the books of British manufacturers and traders.

BALANCING AND SUSPENDING THE MOVABLE COIL OF A MARINE DEAD-BEAT GALVANOMETER.*

By J. RYMER JONES.

The improvements here described consist in the means provided for balancing the coil; in the method of attaching the suspending wires; in substituting rubbing and self-cleaning, instead of vertically *pressing* contacts, as usually employed; and also in the manner of safeguarding the coil by keeping it in a practically central position between the magnet-poles while the suspension slide is being put into, or removed from, the instrument.

In the first and most successful of the methods hitherto employed for balancing a marine galvanometer coil (suspended by means of a taut-wire attached to fixed central pins provided, one at the top and another at the bottom end of the coil frame), equilibrium between the *back* and *front*, and also between the two *sides* of the coil, is effected by slightly bending pieces of lead wire, soldered to the back and front of the coil frame, in the direction necessary to make the axis on which the coil turns pass exactly through the coil's centre of gravity.

In a later device the upper suspending strip is attached to a small nut which is engaged by the threaded shank of a screw, turnable in fixed bearings on the coil, and serving as an adjustment to make the nut traverse a small platform on the top end of the coil frame, thereby virtually altering the point of the wire's attachment to the coil. At the lower end of the coil frame the other suspending wire is attached to another nut, which can also be made to traverse a similar platform, at right angles to the upper one already referred to. This latter adjustment is intended to balance the coil for *rolling* and the top adjustment for *pitching* movements of the ship.

It is found that, with the means afforded by either of the above well-known alternative methods, patience, practice, and repeated trials are necessary to effect a perfect balance, more especially at sea and in the unfavourable conditions and often dim light of the ship's testing room.

The chief difficulty arises from the fact that the adjustment for equilibrating, say, the back and front of the coil affects in some degree also the equipoise of the two sides, and *vice versâ*; and this is found to be especially so in the second of the balancing methods above referred to. Moreover, in the latter method the extra weight of the balancing attachments adds considerably to the weight of the suspended coil, increasing the sag and therefore necessitating either stronger suspending wire, and consequently a smaller galvanometer constant; or else tighter straining, which involves greater risk of breaking.

In the writer's improved method, readjusting the balance between the back and front of the coil is effected by the simple device (fig. 1) of providing a piece of wire (b^1) about $\frac{3}{4}$ in. long, with a screw thread throughout its length, which can pass through a hole drilled in the exact central axis of the upper pin (p^1) of the coil frame. If, then, this adjustable piece of wire passes through the exact central line of suspension, it is evident that altering the length protruding on either side of the pin, in order to effect a perfect balance between (say) the *back* and *front*, will not in any material degree affect the balance between the two *sides* of the coil; and, on the other hand, altering the length of a second similar piece of wire (b^1) intended to supply an equipoise between the two *sides* of the coil, but at right angles to the first wire, will not upset the degree of balance already effected between the *back* and *front* of the coil, *provided that this adjustable wire also passes exactly through the central line of the coil's suspension.*

The important fact that the balancing adjustment for the two *sides* does not affect the degree of equipoise already existing between the *back* and *front* (or *vice versâ*) very greatly facilitates the perfecting of the coil's balance.

When first balancing, the wires may be easily and quickly screwed in or out, as required, by hand for a coarse adjustment; and, holding the extreme *flattened* end of the wire with a pair of tweezers, will enable the operator to appreciate what small fraction of a turn he is giving to the wire for the final perfecting of the balance by that particular adjustment.

This method of balancing is applicable to the coils of other marine galvanometers.

Another improvement consists in the method of attaching the suspending wires (w^1 and w^2) to the pins (p^1 and p^2) fixed at the top and bottom of the coil without any solder. This is done by drilling three small holes (d), about $\frac{1}{2}$ in. apart, in the central line of the pin's length; then reeving the end of the suspending wire through all the holes, in the manner indicated on the left of fig. 1; and finally securing the free end with a suitable lapping of very fine wire or silk thread. The edges of the holes (d) are rounded off to prevent their cutting the suspending wires at sharp angles when subjected to tension. After securing the ends of the wires with the silk thread lapping, the slack is taken up by the tension screw (x), which also tightens up the loops between the rectangular bends, and thus prevents any risk of drawing out the ends, and perfects the contact with the coil pins. Moreover, the suspending wires may be more highly strained with considerably less risk of breaking than when using solder to attach the wires to the coil pins; for not only does the heat while soldering reduce the temper,

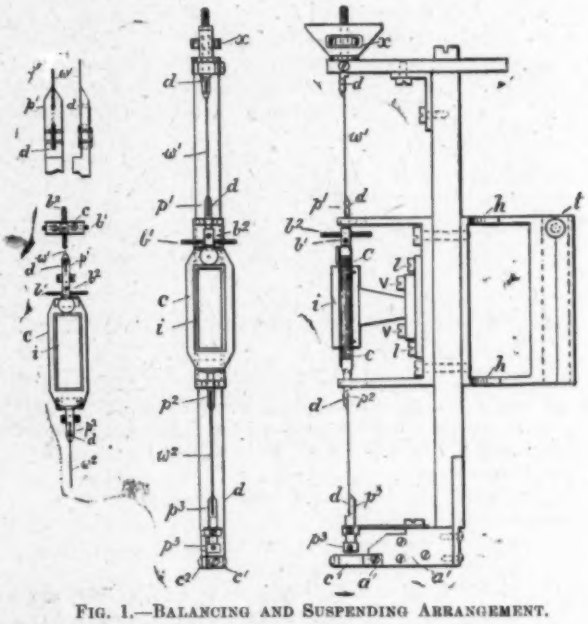


Fig. 1.—Balancing and Suspending Arrangement.

but the softened wire is more likely to stretch under prolonged tension, and this will change the *constant* and upset the balance.

Unless, during a re-suspension, the new wire be very carefully soldered close to the *flat* surface of the pin, so as to leave the end of the pin in a perfectly straight line, not only is a previous balance quite upset, but the wire is also very liable to break, even when only reasonably strained. Moreover, if solder be used, it is very often found that the re-soldered end of the wire has been slightly displaced by the tool, so that it does not lie quite in the central line of the coil's pin. In that case, also, a former balance is wholly upset, and one side of the coil may hang too near to the soft iron core (i). If not excessive, this contingency is provided against in the form of two screw adjustments (l and v), enabling the iron core (i) to be shifted either laterally or longitudinally; but it is much safer to use no solder.

In the improved method of attaching the suspending wires to the coil by reeving the ends through the holes (d) in fig. 1, in order to dispense with soldering, the suspension,

* Patent Specification No. 108,649. Application March 19th, 1917; complete (accepted) August 16th, 1917.

if broken, can quickly be renewed, and the line of suspension will be equally well centred every time. The method can be applied to coils of other forms of marine galvanometer.

A further improvement is the substitution of rubbing contacts (c^1 and c^2) for the usual *pressing* contacts, because the latter will hold dust and press it on to the spring contact below, whereas the rubbing contacts are self-cleaning.

With this innovation, moreover, no spring contacts are necessary on the base, so that a wooden base, with only three ebonite pillars to insulate the magnet and slide, suffices instead of the ebonite slab usually required.

Safeguarding the coil during the act of inserting it into, or removing it from, the galvanometer is effectually provided for by using *two* upright rods instead of only the usual one. One rod enters the tube (t) at the back of the slide, and keeps it in a vertical position, while a second rod placed nearer to the front, and which passes through holes (h) in the slide frame, prevents it from being deflected to the right or left sufficiently to bring the coil in contact with the magnet-poles.

An additional safeguard exists in the fact that by the time that the lower end of the coil reaches the top of the magnet-pole the contact arm (a^1) of the slide has already entered a slot cut in the brass plate and wooden block supporting the magnet; and further down it is limited in its lateral movement by the two contact springs which also serve as guides.

The galvanometer coil (C) is doubly wound, the inner end of the one half and the outer end of the other half being connected together and to one terminal, and each of the two remaining ends to other terminals on the base of the instrument, so that the two equal windings can be joined up for testing either in series in the usual way, or differentially when so required for the "Rymer-Jones High-Resistance Break Test."

The provision of a fourth terminal is necessary in order that the magnet and metal surrounding the coil may conveniently be connected to one extreme end of the coil when the two windings are joined up in series, and alternatively to the *junction* when they are connected up differentially—the object of this well-known and effective expedient being to bring the magnet poles and surrounding metal to the same potential as that of one of the *ends* of the coil in the *series* case; or as that of the *junction* between the windings when they are differentially joined up, and thus prevent any displacement of the spot from its instrument zero, which would otherwise arise from static attraction.

To convert the instrument into a highly sensitive galvanometer for use on shore, the tension of the lower taut wire is either relaxed by raising the bottom pin (p^2) or, preferably, this wire is removed, and a piece of very slack wire connected between the small screws provided for this purpose is substituted in its stead. Not only will the instrument then be ten or even twenty times more sensitive than with the bottom wire (w^2) taut, as used on board ship, but discharge throws from a cable or condenser will be much more easily observed, because the swing will be slower and dead-beat. For use on shore three screws are provided in the base for levelling.

As the base boards are fitted with trunnions, the front of the instrument can be tilted up or down, by means of back and front adjusting screws, in order to raise or lower the spot of light as required to bring it on to the scale when the galvanometer is set up.

As a good spot depends on the lamp and its lens being so adjusted as to direct the best beam obtainable on to the galvanometer mirror, it conduces greatly to this end, and is found very convenient that, by means of this galvanometer tilting adjustment, the height of the lamp and its lens need not be regulated to suit the height of the galvanometer scale.

During very heavy weather at sea, and when not in use at night, the galvanometer can be secured, so that it does not shift its position on the anti-vibration pad—in case the rubber guys provided are insufficient—by means of special insulating clamps, which can be quickly raised to remove the pressure while tests are being made.

ELECTROCULTURE EXPERIMENTS AT LLANTWIT VADRE.

An interesting series of experiments on the stimulation of plant growth has been carried on, near Pontypridd, during the last two years on the field of the Star-Delta Potato Club, which is connected with the South Wales Electrical Power Distribution Co., of which Mr. W. A. Chamen is the engineer and general manager. By the courtesy of the assistant manager, Mr. C. T. Allan, we have been favoured with a copy of the report on the results obtained, which we extract the following particulars:—

The field had an area of 2·07 acres (see fig. 1), and the soil consisted of a typical heavy loam, approximately 70 per cent. clay and 30 per cent. sand. In 1916 the field had grown oats, but in 1917, when taken over about March, it had been two-thirds ploughed. This was completed, but no manure was used in 1917.

In March, 1918, 41 tons (20 tons per acre) of colliery manure was spread evenly over the field. In April the field was ploughed once lengthways, then harrowed and rolled. After this, 10 cwt. of 30 per cent. super-phosphate and 2½ cwt. of sulphate of ammonia was spread over the surface. It was proposed then to cross-plough, but owing to difficulty in obtaining a plough, and also to the planting season being due, the growers were compelled to open planting drills, and found only a fair tilth.

In 1917 potatoes were planted during the first week in May, and were lifted in the first week in October with the following results:—

	Cwt. planted.	Cwt. lifted.	Ratio.
King Edward ...	2	4·46	2·25 to 1
Irish Up-to-Date	20	81·7	4·0 „ 1
King's President	19	171·0	9·0 „ 1
Arran Chief ...	7·5	35·71	4·75 „ 1
	48·5 cwt.	292·87 cwt.	6·0 „ 1

In 1918 potatoes were planted in the first week in May, and lifted in the second and third weeks in October with the following results:—

	Cwt. planted.	Cwt. lifted.	Ratio.
Templar from Loch Leven.	48·6	370·4	7·6 to 1

For the purpose of the experiments, 400-volt, 25-cycle, single-phase current was stepped up by an oil-cooled, 10-K.V.A. transformer to 32,000 volts, and rectified with a Delon type of rectifier,* which held the voltage to 29,000 in dry weather and to 30,000 in the wettest weather. The apparatus gave no trouble at all, and held this voltage in the heaviest rain.

The area under electroculture was divided as follows:—

	1917.	1918.
Electrified area ...	1·21 acres	1·096 acres
Control area	0·86 „	0·977 „
Total	2·07 acres	2·07 acres

In 1917 the network consisted of 5,850 yards of No. 24 S.W.G. galvanised steel wire. The wires were spaced 6 ft. apart, with cross wires arranged in the same way, so as to make a mesh 6 ft. square. These wires were supported from main copper carriers of No. 6 S.W.G. The network at first was supported on E.H.T. insulators about 6 ft. 6 in. from the ground; later, on August 14th, this distance was reduced to 5 ft.

In 1918, 1,860 yards of the same size of wire was used, but the wires were spaced 9 ft. apart, with *no* cross wires. The network was movable, and was kept as nearly as possible 2 ft. above the haulms.

The 1918 arrangement was at right angles to that of 1917.

* See Electrical Review, February 18th, 1916.

The voltage was measured in 1917 by a Kelvin and White electrostatic voltmeter, reading to a maximum of 100,000 volts. In 1918 it was measured by a sphere gap, previously calibrated. For measuring the current a Ferranti, D.C., 0-100-volt, moving-coil voltmeter (with the resistance cut out), calibrated as a milliammeter, was employed. This instrument, of course, gave the polarity as well as the value of the current. The synchronous motor being four-pole, by shifting the adjustable stationary arm of the rectifier a quarter revolution, the polarity could be reversed if necessary, but the network was kept positive. The ammeter was fixed on the negative.

In 1917, as stated already, the voltage varied from 39,000 volts in dry weather to 30,000 in wet weather. In 1918 it was 36,000 volts; and this did not vary 5 per cent. either way, the lower voltage being obtained during heavy rain and the higher during drier weather.

The current in 1917 varied from 2·5 milliamperes in dry weather to 4·0—7·0 in wet weather. In 1918 it varied from

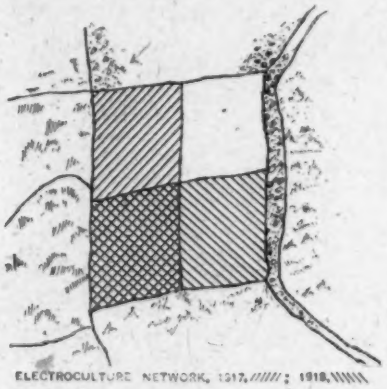


Fig. 1.—Potato Field at Llantwit Vadre.

0·35 in very dry weather to 0·8 during heavy rain, with an average of 0·5 during the normal damp weather prevalent in the district.

It was endeavoured to keep the voltage constant during the treatment, and it is interesting to note the lower readings during 1918, which may be accounted for by the smaller amount of wire used as compared with the previous season, the ratio being 3 : 1. Further, the insulators used during 1918 provided a smaller leakage path.

Treatment was usually given between the hours of 6 and 9 in the morning and 7 and 10 in the evening :—

	1917.	1918.
Commenced Aug. 10 ...	Morning, 118 hours.	June 22, 294 hours.
Finished Oct. 1 ...	Evening, 164 „	Sept. 27, 294 „
Total	282 hours.	588 hours.

The results of electroculture were as follows :—

	1917.		1918.	
	Tons.	Tons per acre.	Tons.	Tons per acre.
Electrified ...	9·1	7·5	10·3	9·46
Control ...	5·5	6·4	8·2	8·40
	Increase ... 17·2 %		Increase ... 12·6 %	

As previously stated, the apparatus never failed and was successful throughout, although difficulty was expected in keeping the network charged during heavy rain. On dark nights it was easy to see the glowing network wires. In the rectifier hut grass grew extremely quickly through the rough flooring of old sleepers, especially under the voltmeter, and in the dark the tips of the blades could be seen glowing, but, after some days, these went a dark brown, evidently showing that the discharge was too intense. Insects, such as butterflies, &c., on many occasions were observed, and it was noticed that when flying under the network they kept very close to the ground, or else flew back away from the wires. Insects that happened to alight on the wires in the hut could be seen glowing in the dark, and in most cases after the current was shut off they were found to be dead.

It was noticed in both seasons that the potato haulms under the network kept green much longer than those on the control portion.

Although the percentage increase in 1918 was less than in the previous year, it is to be noted that the total yield was increased from 14·6 tons to 18·5 tons, and although the treatment during 1917 only lasted seven weeks, as compared with three months during 1918, the decrease might be explained by the smaller area of network wire in 1918; but it should also be noted that, owing to the network in 1918 being arranged at right angles to that of 1917 (see sketch), about one-quarter of the 1918 control portion had been under the network the previous year.

It was unfortunate that, owing to the weather being so wet during the gathering of the 1918 crop, it was not possible to weigh separately the potatoes taken from each quarter of the field.

Cost of Equipment.

Transformer of 10 K.V.A. 400/120,000 V. ...	£204	0	0
3-H.P. synchronous motor for rectifier ...	55	0	0
	£259	0	0
Making rectifier arms, &c., approx. ...	£41	0	0
	£300	0	0

It is estimated that this equipment could easily deal with 100 to 150 acres.

Two-Acre Voltage Equipment.

Galvanised steel wire...	£2	8	0
Supporting wire, steel, say	2	0	0
Sapling poles, insulators, say eight at 10s...	4	0	0
Labour, say	4	0	0
	£12	8	0

A "Danger Notice" was kept at the gate of the field warning people of the high voltage, and this probably had a deterrent effect on prospective thieves, but did not prevent a big cart-horse breaking through the hedge during 1917, which afterwards received a shock, departing with a good portion of the network attached to it. The horse did not return, but we understand that it was undamaged. This year a sheep dog got under the network, and after receiving a shock through its tail, it departed very hurriedly, making loud noises, and also did not return. Our informants are not sure what ill-effects it received, but say they certainly knew its *voice* was in good order whilst it was within hearing!

In an adjoining field, in 1918, an experiment was made on a crop of oats, but owing to various difficulties it was not possible to carry it out thoroughly. The results seemed to point to an approximate increase of 35 per cent. in grain and an increase of 17 per cent. in straw.

Demobilising Munition Workers.—In connection with discharges of munition workers, the Minister of Munitions wishes to point out for general information that (with the exception of persons engaged in manual labour on certain building and construction work, certain classes of sea-going engineers and workmen engaged in ship repairing or whose employment is of a discontinuous or temporary nature) workpeople engaged on or in connection with the manufacture of munitions are in general entitled in accordance with the provisions of Sec. 3 of the Munitions of War Act, 1917, to a week's notice of discharge or a week's wages in lieu of notice. If, therefore, a munition worker (not falling within the above exceptions) is discharged with less than a week's notice or wages in lieu thereof, he or she can complain to a Local Munitions Tribunal and claim payment of a week's wages in lieu of notice by the employer. All necessary particulars, together with the proper form of complaint, can be obtained from any Employment Exchange. The Minister of Munitions would be glad if employers generally would give their workpeople as early an intimation as possible of any intention to discharge, and would in all cases give the Employment Exchanges at least a fortnight's notice of impending discharges.

Electric Welding in Shipbuilding.—The displacement of riveting by electric welding in ship construction is being considered in insurance circles, with regard to possible reduction in rates. It is claimed that welded plates stand the impact test as well as riveted plates, but underwriters require further information on the question of the results of stranding and collision. The costs under these heads are extremely heavy at the present time, as shown by the heavy increases in premiums on hulls. The cost of electric welding is stated to be much below that of riveting. So far, principally small boats have been tested with the new process, and a recent experiment shows that in the case of a barge which was electrically welded at a cost of about £300, the tender for riveting the vessel was £450.

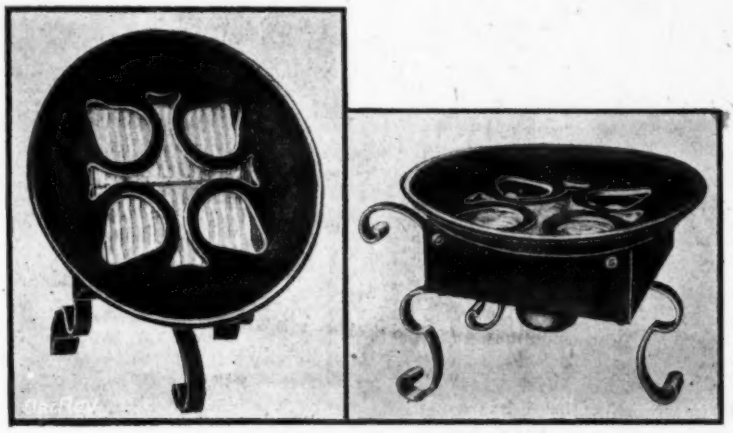
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Combined Electric Heater and Cooker.

The "Beco" combined radiator and stove is a new device introduced by Electrical Components, Ltd., of 36, Cannon Street, Birmingham. In its upright form (fig. 1) it is used as a radiator, and in its horizontal position (fig. 2) it is adapted for cooking and domestic purposes. The apparatus is of solid construction, there being no swivel nuts, screws, or springs to get out of order, and consists of a square, cast-iron case containing the elements, mounted upon scroll legs, and having a circular, dished, ornamental front, which also serves as the top of the stove when used for cooking. Four legs are provided, so arranged that in whichever position the heater is used it stands firmly upon three of them, the fourth leg doing duty in each case as a handle. In changing over from heating to cooking, or *vice versâ*, it is only necessary to tilt the stove into the required position.

The elements consist of continuous spirals of nickel-chromium wire arranged in parallel coils on the surface of porcelain formers. Two such elements are used, the loading of the two together being either 1 or 1.5 kw., as desired.



Figs. 1 and 2.—The "Becq" Combined Radiator and Stove.

With the higher loading independent control is provided for each of the two elements. The switch or switches are mounted on the back of the element case, where also is the plug for connecting up. The front of the apparatus may be of malleable iron, either japanned black or nickel-plated, or of solid cast brass, polished. The apparatus is stocked in all the usual voltages.

"Izolex" Replacement Fuse.

A new type of replacement fuse has been placed on the market by Messrs. Ward & Goldstone, Sampson Works, Manchester, which, apart from its novelty of design, occupies no greater space than that needed for the dial-pattern cartridge fuse, while retaining the convenience of the open-type replacement fuse. At present it is made in sizes up to 15 amps., but larger patterns for currents up to 200 amps. at voltages from 250 to 500 are in preparation. From the illustrations it will

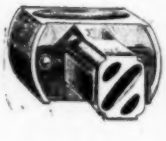


Fig. 3.—Fuse Carrier.

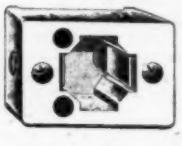


Fig. 4.—Base, with Carrier Removed.

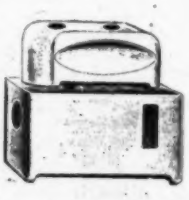


Fig. 5.—Complete Fuse Unit.

be seen that the fuse consists of two parts, the fixed base (fig. 4) and the detachable carrier (fig. 3). The tongues on the carrier are of U-shape to ensure good contact, while the contact plates in the base are flat, and arranged parallel with one another. These contacts, being solid, have no tendency to deteriorate, as is the case with spring clips. Provision has been made for ready replacement, although, owing to the substantial form of the clips in the carrier, they are unlikely to need renewal. The fuse itself is threaded through a diagonal hole formed in the porcelain body of the carrier, and when the latter is in position (fig. 5) no metal parts can be touched by the hand. When the "Izolex" fuse is required for single-way circuits only, and is not to be mounted up in fuse-boards with bus-bars, it can be fitted with in-going and out-going terminals. It is recommended that "Testotin" fuse-wire be used with these fuses. Suitable ironclad cases to accommodate single-pole or groups of fuse units are supplied, these being designed with ample space at the sides so as to facilitate wiring up. The china bases are raised to permit of the wires being passed below, the main cables being fitted in full view, while the in-coming cable holes are bushed, but can be screwed to take conduit at small additional cost.

Industrial Lighting Fittings.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, have issued a new catalogue of industrial lighting fittings, which includes many new designs of inexpensive reflectors and lanterns, suitable for factory use. The workshop reflectors are shown in many sizes, arranged for intensive and extensive illumination. In these days, when economy and efficiency are the watchwords of factory practice, it behoves all works engineers to look well to the lighting of their works, and see that light is not wasted in glare and shadows. There are sufficient designs illustrated in the list before us to meet all the requirements of any well-lighted works, while we note, also, that the prices are low. The outside lanterns shown vary from small sizes, suitable for 100-watt gas-filled lamps, up to the large lanterns taking

Fig. 6.—Simplex Lantern for Gas-filled Lamps.—Light Pattern.

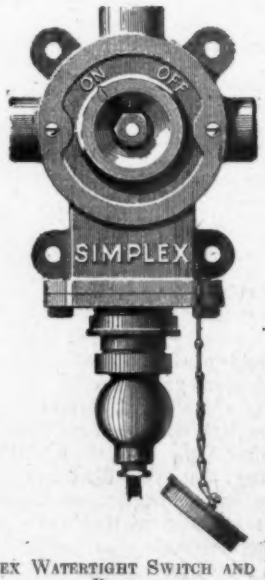


Fig. 7.—Simplex Watertight Switch and Plug.—Heavy Pattern.

1,500 watts. There are several patterns of each size shown, some quite light and inexpensive (fig. 6), suitable for factory and subway use, and others much heavier and more expensive, suitable for railway or street lighting. They are specially designed for the economic lighting of large spaces. There are also shown indirect and semi-indirect fittings of inexpensive types, for drawing offices, booking halls, shops, &c. At the end of the catalogue are illustrated switch and plug fittings (fig. 7), designed for heavy factory use and special positions where both watertightness and gastightness are desired.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Coal Economy.

With reference to the appeal which my Committee made in the Press that electric supply stations should assist the Coal Controller in distributing circulars with a view to urging the public to economise in coal, I should like to say that the appeal met with a most gratifying response, and the following letter will be of interest to those who thus kindly assisted:—

Board of Trade,
Coal Mines Department,
Holborn Viaduct Hotel.

T. W. Cole, Esq., *November 20th*, 1918.
The Provincial Electric Supply
Committee of the United Kingdom.

Coal Economy Circulars.

Dear Sir,

With reference to the assistance which has been given by member companies of your Committee and other undertakings in distributing circulars on coal economy, would you kindly convey to these companies the thanks of the Coal Controller, and inform them that the Department very much appreciates their kind help, which we feel has been of material value.

May I point out that there is little promise of an alleviation of the serious coal shortage this winter, and that the utmost economy in the consumption of fuel and light is still necessary.

Yours faithfully,
(Signed) C. W. Sandeman,
Director of Publicity.
T. W. Cole,
Secretary,
Prov. Elec. Supply Committee.

London, E.C., *November 27th*, 1918.

"To Him that Hath ——,"

In an article recently published in your columns,* the writer expressed the fear that the clerical worker in munition factories would not receive, at the hands of the Government, the same consideration as was extended to the manual worker when munitions of war were no longer required, and a perusal of the Government "out-of-work" donation scheme, which allows for benefits to be paid only to persons who come within the scope of the National Health Insurance Act, will prove that the fear was well founded.

Persons insurable under the Health Insurance Act are all manual workers, whatever their wages may be, and those clerical workers whose income does not exceed £160 per annum. Thus it will be seen that out-of-work benefits will be paid to those workers who, during the past four and a half years, have been in receipt of unprecedented high wages, amounting in many instances to between £500 and £600 a year, and yet denied to all clerical workers who have been fortunate enough to earn more than £160 per annum.

Many thousands of clerks, from an actual wages standpoint, are really eligible for benefits under the National Health Insurance, but as the war bonus they receive has brought their income slightly over the £160 limit, they are deemed to be ineligible, and their contributions have been dispensed with. This has come into effect quite recently, doubtless on the assumption that their income will not descend below the limit, but when the clerk is thrown out of employment, and has nothing to fall back upon, he will probably be obliged to accept a job at his pre-war rate of pay, without the war bonus he at present enjoys.

It is impossible that this miserable distinction can be tolerated. Is it logical that the comparatively low-paid clerk (for what is £3 per week worth in these days?) can save in anything like the same degree as his much better paid manual confrère? Why should this distinction be made between the manual and the clerical worker? The Government feels that the manual worker is likely to incur hardship owing to temporary unemployment, and has granted out-of-work donations in consequence; but surely the same ill-effects are likely to be felt by the clerical worker, even if his war-time income has exceeded £160 per annum. The manual worker has at least had the opportunity of putting a bit by for a rainy day, but it looks as though the Biblical quotation, "To him that hath shall be given," was in the mind of those responsible for the framing of the "out-of-work" donation scheme.

It is not suggested in this letter that the out-of-work benefits should not be paid to the manual workers who have been in receipt of high wages, for it is recognised that, high as these wages are, the terribly high cost of living has greatly reduced their value. It must, however, be remembered that the clerk, with his £165 or £170 per annum, has to pay exactly the same as the manual worker for the necessaries of life, and as the chances of temporary unemployment are at least equal, it is only fair that the same consideration shall be extended to the clerk as to the mechanic. The Government scheme should be amended forthwith, so as to embrace *all* workers (no matter what their war-time wages may have been) who during the change-over period are thrown out of employment.

M. E. Nicholls.

* Elec. Rev., November 22nd, 1918.

The Royal Albert Hall.

I notice in your issue of last week a paragraph in regard to the above, which says that certain people "removed a paving stone outside the Hall and cut off the electric supply at the main." I am sure everyone will agree that it would be very unfortunate if such an example were seized upon as a normal weapon of retaliation, and I think in this connection it might not be unwise to draw attention to a provision in the Electric Lighting Acts, a consideration of which might possibly form a deterrent to anyone who had memorised the method as one to pursue should occasion arise. Section 22 of the Electric Lighting Act, 1882, reads as follows:—

"Any person who unlawfully and maliciously cuts or injures any electric line or work with intent to cut off any supply of electricity shall be guilty of felony, and be liable to be kept in penal servitude for any term not exceeding five years, or to be imprisoned with or without hard labour for any term not exceeding two years."

Electric Supply.

London, E.C., *November 30th*, 1918.

Charges for Electricity.

The summarised list of price increases made by electrical undertakings in your issue of July 26th is an interesting and valuable one. I note that the majority of undertakings have increased their prices for lighting and power by either a fixed amount per unit or by some percentage.

In our undertakings at Ballarat and Bendigo we have made certain increases in the price of electric light and power during the war, but owing to the frequent increases in the price of coal that we have in the last few years had to face, I considered it desirable to introduce a coal clause, which would be applied automatically as soon as an increase occurred to all power consumers, both large and small, with the exception of those taking 50 and less units per month.

Commencing from the beginning of this month we have introduced a new tariff, as per the enclosed printed note.* An endeavour has been made in drawing this up to provide for all possible contingencies. It will be noted that the coal from the State coal mine, which is our main source of supply, is taken as the basis, but, owing to strikes and stoppages at this mine, we have frequently to fall back on coal from New South Wales, which has to be shipped to Melbourne, 650 miles, and then carried by rail 75 miles to Ballarat, and 100 miles to Bendigo. Our State mine coal is carried by rail 161 miles to Ballarat, and 188 miles to Bendigo.

All our coal reserves have to be Newcastle coal, and not our basis coal, owing to the latter seriously deteriorating under storage. We may, in addition, have to provide for the use of other classes of coal of inferior calorific value, and in view of the possibility of a shut-down of black coal supplies, the use of brown coal as an emergency measure. For these reasons the *average* cost of fuel is compared with the basis.

The basis is the cost delivered in bunker, which provides for extra carting and handling charges, when reserve stocks have to be drawn on during strike periods.

It will be noted also that the relative calorific values of the various fuels are provided for in the estimated price, and when the reserve stocks are consumed these will be priced not at their purchase value, but at their current, or their replacement, value. If, when these reserve stocks are consumed, the replacement value is unknown, then the price current prior to the strike is taken, and later on, when the renewal price is known, the difference between these two on the number of tons consumed from the reserve stocks will be spread over some future month or months' costs of fuel delivered in bunker.

*Power, heating, cooking, ventilating, and other purposes, at 3½d. per unit for the first 38 hours' use per month of the maximum demand, and 1½d. per unit afterwards.

The above tariff is based on coal (from the State mine) delivered in bunkers at power house at 21s. 6½d. per ton, and for every increase of 6d. per ton in the monthly average cost of fuel above the basic price a charge of .015d. per unit will be added to the tariff. In the event of reserve stocks or other fuels being used the relative calorific values and current or renewal prices will be calculated on the above basis.

D

Consumers using up to 50 units monthly are increased by ½d. per unit. In previous alterations in power tariff the hours' use of the maximum demand was extended, and the majority of these small consumers, principally private houses using power, did not face an increase in price, because most of their units were consumed at the 3½d. per unit rate. As they were not affected, therefore, by the previous increases, we are combining that with the present super-charge, and putting them up a flate rate of ½d.

Consumers taking up to 50 units per month represent 77½ per cent. of all our power consumers. In bringing in the present super-charge we have to provide for a 4s. 6d. per ton increase in fuel, or nine times the basic super-charge of .015d., representing .135d. per unit. Approximately eight times this represents 1d.

For convenience in calculating the super-charge to be added to the bills, a ready-reckoner has been prepared, working out the cost in even pence for every seven and eight units alternatively. The amount of additional clerical work, therefore, in dealing with this super-charge will be of little or no importance. In the event of, say, another 1s. 6d. increase in the price of fuel the super-charge would be increased from nine times the basic price to 12, and a new ready-reckoner would be prepared to deal with the same.

Coal clauses are frequently provided for very large consumers, or for special-rate consumers, which automatically come into force when an increase in fuel takes place. It is, however, somewhat incongrous for a super-charge to be immediately made in the case of such consumers, and the smaller consumers to escape until such times as the increases in the price of fuel has necessitated a general increase in the tariff.

The price of fuel is causing many of the Australian undertakings as much concern as the home ones. For instance, slack at the pit has increased from 6s. to 16s. 6d. in six years, or an increase of 175 per cent.

P. J. Pringle.

Ballarat, Vic., *September 24th*, 1918.

"Fraternity"—or Tyranny?

With regard to the correspondence which has taken place recently in the Electrical Review on the pros and cons of the E.P.E.A. and the E.T.U., I wish to endorse "Borough Electrical Engineer's" views in relation thereto. I am writing as a member of the E.P.E.A., and I have come to feel that some means should be found of associating ourselves with the E.T.U. The E.T.U.'s methods in the past have perhaps not altogether been to our liking, but with the assistance of engineers I feel confident the tone of the union would be improved to the benefit of both sections, including a more amicable working arrangement between the engineers and the workmen.

Only this week certain corporations have turned down our demand for a reasonable advance. What is our remedy?

One of the Corporation officials' answer was: "You will receive nothing except by using force." Now this policy, to my way of thinking, leads to the use of drastic remedies, and so long as many undertakings are managed by clerical managers and corporation committees a strong union is the only means whereby the technical engineering staff will ever be recognised.

Plain Speaking.

December 2nd, 1918.

Smooth versus Undercut Commutators.

The following remarks, based on personal observation over considerable periods, may be of interest to your readers.

Motors of 460-500 volts, 10-50 h.p. running day and night at from ¾ to full load, shutting down for an hour or so every 24 hours to enable examination of brushes, &c., to be made, having commutators undercut to about ¼ in., have never given the slightest trouble. In fact, the only trouble I ever experienced with this type of commutator was on a 50 h.p. motor, and this was caused by rain leaking through the roof on to the commutator, which must have caused the carbon dust lodged between the bars to become damp and caked, but as the motor was on very urgent work it was allowed to run through the night on full load, with the result that a number of segments were badly burned, necessitating the commutator being rebuilt.

Motors of the above ratings, running under exactly similar conditions, with smooth commutators, always seemed to be in trouble.

1. Mica would get high, resulting in bad sparking and the burning of "flats" on the commutator, and in some cases I have known a motor with high mica actually wear a full inch off a new set of carbon brushes in a run of 24 hours at full load.

2. Dust seems to settle on smooth commutators with remarkable rapidity, and getting under the brushes soon gives rise to sparking.

3. Overoiling of motors seems to cause considerable trouble with smooth commutators to a much greater degree than with those of the undercut variety.

Commutators should be built up with mica, and the various grades of micanite and mica substitutes should be avoided, as my experience has always shown that 75 per cent. of commutator breakdowns occur on those commutators insulated with substances other than mica.

Most commutator troubles are due, not so much to the actual running conditions as to the starting conditions, and as soon as the makers of starting apparatus come to the conclusion that a properly graded resistance is the most important part of a starter, coupled with a slow motion device, in such a manner that it is impossible for the most unskilled operator to start the motor under any but sparkless conditions, the greater part of commutator troubles will cease. This applies more to smaller motors, which in many cases are installed with very little thought about the starter, and the starting up is usually done so rapidly that the starter might be ignored and starting effected merely by the closing of a double-pole switch.

I consider the ideal combination to be a motor with commutator undercut to a depth of ¼ in. for large machines, and just below the surface for small machines, connected to a starter fitted with no-volt and overload release and a slow-motion device, which would make it impossible to start up the smallest motor so that the slightest spark could be observed on the commutator.

P. Hayes.

Leytonstone, *December 2nd*, 1918.

Having made a very close study of this particular question, which I see is being debated in your "Correspondence" column, I have pleasure in placing the following data at your disposal:—

Commutator trouble, *i.e.*, sparking at the brushes and over-heating of the commutator of d.c. generators and motors, including the single-phase repulsion motor, is due in most cases to the mica between the segments swelling as the commutator becomes heated, consequently the carbon brushes may not be hard enough to scour the mica away, and the result is violent sparking.

To permanently overcome this contingency, manufacturers began to turn out machines with the segment mica slightly reduced below the level of the commutator segments. They also supplied a particular grade of brush to suit these conditions, which should not be altered for any other grade or quality.

A carbon brush suitable for machines with undercut mica needs to be exceptionally tough, and of dense texture, otherwise the channels in between the segments will break away the heel or toe of the brush, particularly so in the case of reversible motors. As regards motors, the totally-enclosed type should always have the mica slightly reduced, owing to the difficulty of getting at the commutator.

As regards generators, the practice of slightly reducing the micas is practically adopted in most generating stations. I have seen as many as twelve 400-kw. machines running continuously, all of which had undercut micas.

Any machine which is being worked at heavy load, and which has level micas and soft brushes, will have sparking trouble. If brushes of a harder grade were substituted to scour away the rising mica, they would probably not carry the necessary current, and become red hot, as I have often seen where this remedy has been tried.

Any machine having reduced micas, and which becomes clogged in the channels with carbon dust and paraffin wax applied very often in desperation by the attendant, has most certainly the wrong type of brush for the job.

If the cutting down of the micas is performed on the spot, great care should be taken to cut the exact width of the mica; a hard steel cutting tool with a curved hook end should be used in conjunction with an arched piece of sheet steel the full width of the commutator to act as a straight edge to cut along.

Unless this work is done by a practical man it will not be successful, and probably will make the trouble worse. Also after it is done, apply a full-width, curved wood block, covered with carborundum cloth, until the commutator is perfectly smooth. Change the brushes if too soft.

The Morgan Crucible Co., Battersea, supply the proper grade of brush for this class of machine.

Henry Fowler.

Liverpool, *December 2nd*, 1918.

Motor Problems.

With regard to the letter from Mr. Ernest F. Butler which appeared in your issue of November 29th, under the above heading, I note the statement that the problem of taking care of the sudden strengthening of the field of a variable speed motor, when stopping, is a new one. If Mr. Butler cares to look through the Patent Office records for, say, 1910 and 1911, he will find there that the problem even at that time was receiving attention.

The solution of the problem which Mr. Butler proposes certainly does not overcome the difficulty, even with two handles, as if we assume for a moment that a 4 to 1 speed regulation is used on a motor, and that the motor is running at full speed on, say, a fly-wheel load, then if the operator suddenly throws his field regulator over to the "full field" position there will be a heavy surge back on to the line, and in many instances I have seen the motor flash over on the commutator.

I am sending you herewith an illustration of a form of combined starter and speed regulator operated by a single handle, made by Messrs. Allen West & Co., of Brighton.

This form of starter does all that Mr. Butler requires, and is, in addition, fitted with an accelerating relay, which prevents too violent speeding up, and also has a decelerating relay, which entirely overcomes the troubles both when slowing down suddenly and when stopping the motor. Curiously enough the form of decelerating relay is somewhat similar to that proposed in your foot-note, and forms the subject matter of a patent applied for by Mr. Victor Breeze.

These two relays are built at Mears. Allen West's own works, and, of course, will not be open to the criticism which Mr. Butler makes on other makes of relay, which I am sorry to say nearly all emanate from America.

I think this form of control may claim to be a solution of the problem as far as its technical side is concerned. As regards the editorial requirements of cheapness and simplicity, the scheme is certainly simple, but the term cheapness is a relative one. For the material in the controller, and the way in which it carries out its work, the form of controller offered is certainly cheap, but I am afraid it will not compete in actual cash price with the ordinary form of manually-operated, face-plate starter, although if compared with some of the more elaborate pillar panels, it comes out very well with regard to price.

F. N. Pickett.

Hove, *December 2nd*, 1918.

[Unfortunately the illustration was not suitable for reproduction. We are pleased to see that our problem is being so seriously tackled, and that the relay solution which we suggested had already been introduced.—Eds. Elec. Rev.]

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

On Tuesday evening last week, Mr. J. H. Shaw, A.M.I.E.E., read his paper (an abstract of which appeared in our issue of July 19th, 1918) at Manchester before the North-Western Centre of the Institution of Electrical Engineers.

Prof. Stoney, discussing the paper, said he was very much interested in the slide of the valve which failed at such a low temperature as 450 deg. What happened with cast iron was that the steam seemed to get in beside the crystals. The steam seemed to get in beside the flakes of graphite, and caused rusting; he had known cast iron grow as much as 3 per cent. in its dimensions, which, of course, totally upset the proportions of the turbine. The cast iron also became quite brittle. He had come to the conclusion that 470 deg. F. was probably a safe temperature to which to subject cast iron, but cast iron growth occurred at 450 deg., showing that not more than 400 deg. was safe. Personally, he had never seen trouble with cast iron at 100 deg. superheat, which gave a temperature of about 450 deg., but he had seen a good deal of trouble with 150 deg. superheat. In order to get higher efficiency the range of temperature would have to be increased. Mr. Shaw had shown very well what benefits could be got from that. Prof. Stoney pleaded that more attention should be paid to the lower limit, that was the minimum potentiality. One should not have more than 20 deg. between the temperature of the cooling water and the temperature of the steam; it was often 30 deg. or more. He was rather surprised to see that in Schedule I Mr. Shaw took the quantity of cooling water as only about 45 times the steam condensed. That meant a difference of 21 deg., or, allowing 6 deg. loss, say 27 deg., between the temperature of the steam and the temperature of the cooling water, except in exceptional cases. Where there was a large lift—as there was sometimes in cooling towers—he would have thought 65 deg. to 70 deg. would have been very much better for the circulating water. It should be remembered that every three degrees saved in the temperature of the condensers meant about 1 per cent. of the steam consumption, and that 12 deg. saved would mean the difference between 365 lb. and 500 lb. It was most important to have clean condensers and efficient air extractors, and a large margin should be allowed for air leaks. Without a steam jet it was impossible to get really efficient air extraction. It was also most important to avoid air getting in the boiler. Semi-steel contained graphite, and wherever one had graphite one was sure to get trouble due to high temperature. Those troubles could be got over by using a good design and suitable material, but the price would be high. A great deal of trouble with turbines had been caused by the almost universal practice of taking the lowest tender. There were several makers of turbines in this country who were thoroughly reliable, but if they were cut down to the last penny by competitive tender the result was sure to be a bad job. He believed the turbine of the future would be a tandem or cross-compound one; it would have a small high-pressure cylinder where the high temperature was taken out. It would be made of steel castings and forgings. With big turbines one came up against the low gauge of the railways, which limited to a very large extent the size of the parts which could be carried; the size of turbines now was a very serious consideration. A point which would have to be very carefully considered was the effect on steels of high temperature. At temperatures such as 1,400 deg. the ductility of steel became similar to that of lead. At temperatures between, say, 600 deg. and 800 deg., there was a certain amount of evidence that the ductility went down to a very large extent. Practically nothing was known about the effect of high temperatures on the shock-resisting properties of steel. The question of glands would have to be carefully considered; he had known a good deal of trouble with certain glands exposed to high-pressure high-temperature steam. Some arrangement might have to be made to cool the steam going into those glands. Upon the whole, he thought that high temperatures and pressures were quite practicable from the turbine makers' point of view provided prices were not cut, and the best designs, materials, and workmanship were used.

Mr. Bauman agreed with the author that it would be much better if energy was spent in improving the steam prime-mover instead of the gas turbine. Every 3 deg. at a lower temperature in the condenser saved so much per cent. of the steam consumption, whereas 25 deg. F. was necessary on the upper limit to get the same improvement. That showed the importance of getting a very low vacuum and keeping the temperature in the condenser low, but more especially one had to get the vacuum through to the open blades. It was no use having it in a condenser if it could not be got through to the moving blades, because that was where the thermal energy was transformed into mechanical work. In order to do that it was necessary to have a large-sized exhaust efficiently designed so as to get a stream-line flow of steam through the blades into the condenser. In addition, it was necessary to have a large leading area, because unless that was so a large leading loss would result, which, again, meant energy thrown away. In Schedule I he noticed that for 500 lb. steam pressure the author took higher efficiency than for 365 lb. pressure; in the last column he took an efficiency of 80.2 per cent. for a superheat of 268 deg. F.; in the third column from the side, with 365 lb. pressure and practically the same superheat, he took an efficiency of 78.9 per cent. That required some explanation. Where small differences were the result of a calculation it was very risky to make a calculation of that kind all the way through without considering step by step the differences due to the various factors. Comparing columns 3 and 5 in Schedule I, one found there was a difference in favour of the higher temperature of 0.8 per cent. in steam consumption. There was a further difference in respect of the power for the auxiliaries. For every 25 deg. increase at the higher temperature—between 650 deg. and 750 deg.—there was 1 per cent. saving in steam consumption. Therefore, as far as the temperature was concerned, he thought it would be safe to say that the highest temperature which the material would stand should be adopted. As far as turbines were concerned, he was certain that 700 deg. F. was quite safe. He accepted the figures given in Schedule II as being reasonable. As far as the heat drop was concerned there was a difference of 5.67 per cent.; a change in efficiency of nearly ¾ per cent.; that meant that between 215 lb. and 365 lb. there was a difference in the heat consumption of 5¼ per cent. If those figures were correct the figures which were given in the paper required to be corrected. Comparing 365 lb. and 500 lb., Mr. Shaw gave a difference in favour of the higher pressure of 5.2, whereas Mr. Bauman made it 3. There was an improvement between 215 and 365 of 5¼ per cent., and between 365 and 500 of 3 per cent. That alteration was very important, because it meant that it was safe to say that 350 lb. should be adopted, because a saving of over 5 per cent. would result, whereas between 365 and 500 it was much smaller. It was very questionable whether with ordinary conditions with a temperature of 750 deg. F. it would pay to go beyond 500 lb. He thought it would pay where the load factor was very high. In the case of a linked-up system with a power station which would work at full power the whole time, it might pay to adopt a much higher pressure. Some alteration was required in Schedule V as well. There it was stated that with the same total temperature there was a difference in the capital which one could afford to expend as between 215 lb. and 365 lb. of £14,500, and between 315 lb. and 500 lb. of £22,000. The speaker maintained that it was just the other way about. He agreed with the author and Prof. Stoney that for very high pressures—anything above 400 lb.—a two-cylinder machine ought to be used. Moreover, it was very desirable that cylinders subjected to very high pressures should be small in diameter. One method of dealing with it was to have a single-shaft turbine, or, alternatively, a cross-compound arrangement. Personally, he thought the former arrangement was preferable, being simpler in many ways. The higher the pressure the smaller the steam pipe, the better it was to build up flexible steam pipes, the easier it was to allow for expansion. It had very great advantages. In conclusion, he said that as far as temperature was concerned, 700 deg. was quite feasible, and turbine makers were willing to guarantee turbines at 750 deg. temperature maximum. He thought there was a good deal to be said in favour of increasing pressure at least to 350 lb. There was very little difficulty as far as turbines were concerned, and from what he gathered there was very little alteration required as far as boilers were concerned.

Mr. S. L. Pearce thought that at the present time there was no source open to them for improving the economy of steam plant other than by increasing the heat range with the prospect of, say, 10 per cent. theoretical gain by so doing. He thought it might be said that with the experience which had been gained, notably at Rugby, the standard water-tube boiler could, with slight modification, be made to operate safely at 375 lb. pressure. If it was desired to go above that pressure very serious modifications would have to be introduced into the boiler. A great deal of experimental and pioneer work remained to be done. He thought it was very debatable whether it would pay to go beyond that figure. Messrs. Babcock & Wilcox were at the present time building boilers at 470 lb. pressure for a station on the Tees-side, and presumably a working pressure of round about 450 lb. was being adopted. The results from that station when it was at work should be of enormous importance. Personally, his own view was very much as summed up by Mr. Bauman, and it was on those lines that they were hoping to develop their new station at Barton, namely, to adopt a working pressure on the turbine of 350 lb., and superheat somewhere approaching 250 deg. He thought it would be agreed that there were thermo-dynamic considerations which would favour high initial pressures rather than high superheats, but the economy would be greater if they kept up the superheat as well as the pressure. He fully agreed with previous speakers that the use of higher pressures would entail the use of pipes of much smaller diameter. At Connor's Creek, the conditions were more or less comparable with those with which the author had been dealing. The results were 1.42 lb. of coal per KW.-hour. That was substantially less than the author's figure of 1.82 lb., and one naturally asked how was it done? Probably the answer would be, "Concentration of plant in large and few units." He thought that was a mistaken development. In the Connor's Creek station they were using some very large boilers. Each of those boilers had 23,500 sq. ft. of heating surface, and they had no economisers. That was a direction in which the British engineer might well give a useful lead. In connection with the Barton station, they were proposing to use boilers of large capacity, the heating surface of the boiler and the economiser together being practically the same figure as he had given for the Connor's Creek boilers—of such capacity that he estimated three boilers would easily supply steam for a turbine of 25,000-KW. capacity. It seemed to him that a turbine of 25,000-KW. capacity at 1,400 or 1,500 R.P.M. could be built of one cylinder so long as the working pressure did not exceed 350 lb. On the other hand, he agreed that high-speed machines lent themselves better to the adoption of very high working pressures, say of the order of 500 or 600 lb. It became a question of balancing the extra capital cost involved in two-cylinder turbines and tandem alternators as against the possible saving that would accrue therefrom.

Mr. Mackenzie said they must feel their way and not make too big a jump at once. They had ample evidence that temperatures about 650 deg. F. could be safely carried without causing serious trouble with turbine blading. The B.T.H. Co.'s experimental plant had proved that 680 deg. could be safely carried, which closely approximated to the temperatures given in Schedule II. It would not pay to attempt to increase the pressure to anything less than 350 lb., and very few cases could be made out where such a course could be economically adopted. With the 20,000-KW. sets that they were installing at Stuart Street with 28 in. of vacuum (not 28½ in., as given in the paper), the condenser maker was stipulating for 800,000 gallons of circulating water per hour as against 940,000 given by Mr. Shaw; he must have got hold of a very good condenser if it was going to give 28½ in. with that quantity of circulating water. In Schedule II the maximum possible saving on the 365 lb. over the 215 lb. was shown as £1,900 per annum, based upon running the plant at full load for 365 days in the year. Overhauling and examination were not provided for. On the 60 per cent. load factor the saving would be reduced to £1,140. This sum would not equal the annual charges on the difference in capital cost between the 215-lb. and the 365-lb. schemes. The maximum possible saving on the 500-lb. scheme over the 250-lb. scheme on the 60 per cent. load factor was £5,100. Allowing sinking fund at 3¾ per cent. and interest at 5 per cent. this would justify an additional capital outlay on the 500-lb. scheme of £35,000. The present-day cost of one 215-lb. pressure, 20,000-KW. turbine, together with its boilers, economisers, feed pumps, and piping—those parts that would be affected by the high-pressure steam—was about £160,000. The sum of £35,000 was 22 per cent. increase on the £160,000. Mr. Pearce stated that the cost of a 350-lb. boiler would be 20 per cent. greater than that of a 200-lb. boiler, and he would like to know what the percentage increase was likely to be for the 500-lb. boiler. However, the present price of coal was at least double the basis price given in the schedule, and this, of course, meant double saving. It was extremely unlikely that it would ever get down to the 10s. per ton that was taken as a basis price. It all rested upon that question. If the boilermakers and turbinemakers were going to charge 25 to 30 per cent. more for the higher-pressure plant than for the 215-lb. plant, he would far rather keep to the 215-lb. pressure. The cooling tower scheme shown in schedule 3 showed a saving of £4,800 by raising the pressure to 350 lb. per sq. in. Clearly in such cases it would undoubtedly pay. The steam pipes for high pressure would have to be very carefully designed; the days of steam pipes 16 in. and 18 in. in diameter were certainly numbered. They would have parallel steam connections from all the marine boilers, and would have to keep those sizes down to a maximum of 10 in. to 12 in. He had had some very unfortunate experiences with steel bolts. When they had been subjected to temperatures of 600 deg. or 700 deg. F. for any length of time they could frequently be broken by dropping a few feet on to the floor. Unless they were very carefully annealed it was likely that most of them would break if used again to make a joint. He was in favour of using good Low Moor iron bolts instead of steel for such high temperatures. With regard to steam valves, at Stuart Street all the internal parts that were made of cast iron had broken and had had to be replaced, and they had also had considerable trouble from valve-makers using for valve-seating material which had a different coefficient of expansion to the valve bodies, so that, after having been subjected to these high temperatures for some time, all the valve seats had worked loose and had to be renewed. The growth of cast iron under these temperatures made it almost impossible to keep the casing joints tight at the high-pressure end. All turbines used for high pressures should dispense altogether with jointing material. The joints should be faced joints with a smearing of graphite or boiled oil. He hoped the time was not far distant when they would dispense altogether with water economisers, using the gases from the boilers for heating the air that would be required for the combustion of the fuel. He knew several large turbines badly designed for low-pressure work. One particularly large turbine gave a difference of 2 in. between the vacuum at the low-pressure end and that actually obtained in the condenser.

Mr. P. Peakman, speaking as a metallurgist, said that the turbinemaker and the boilermaker were quite safe in going up to the temperatures and pressures suggested by Mr. Shaw if they used very carefully selected material. For those high pressures and temperatures they must eliminate cast iron. The oxidation of silicon in cast iron caused growth plus disintegration. At those higher temperatures and pressures non-ferrous metals up to the present were quite a failure. Such materials disintegrated very rapidly and became very brittle indeed. At various temperatures steel was very ductile, but there was no danger whatever in going up to the temperatures that had been suggested. Impact figures at high temperatures would be published very shortly. Low Moor iron bolts undoubtedly gave better results on work where they were going to be subject to fatigue. Vibration or fatigue would not be absorbed so readily by mild steel as by Low Moor iron.

Mr. Bayliss said that Mr. Pearce seemed to know as much as he did about boiler making. Boilermakers to-day had no hesitation in constructing a boiler for pressures up to and including 275 lb. per sq. in. That pressure was being adopted at the station on the Tees-side which Mr. Pearce had mentioned. Apart from central station work, there were several industries in this country, and in Lancashire particularly, that were adopting 275 lb. as their standard boiler pressure for electric generation. There was no economy to be derived from the boiler installation itself in response to those pressures. One direction for progress was that of feeding the boiler with a suitable feed water. In one station, comparatively small, but highly efficient, where the total feed make-up was in the neighbourhood of 7 or 8 per cent., the engineer evaporated water by means of live steam, so that he was practically feeding into the boiler pure distilled water. He must look out for corrosion, but that he was aware of. The result was that he always had a boiler with heat surfaces at maximum efficiency. Under those circumstances 77½ per cent. efficiency was not impossible. Apart from increased efficiency one was able to use the boiler more hours in a year under actual service than otherwise, consequently using capital to better advantage, and perhaps running the station with fewer stand-by boilers than in ordinary working conditions. Too little attention was paid to the coal consumption per shift in relation to the units generated. Each boiler should be fitted with a coal-measuring machine, and each turbine unit should have allocated to it its proper number of boilers. During ordinary working each turbine unit and each set of boilers and the records should be carefully separated. This enabled them to analyse carefully the figures obtained, and set up a healthy competition among the station staff. He thought the failure of bolts connecting steam pipes was due to fatigue in the material set up by stress rather than to the temperature. Such bolts could be readily brought to the original state by annealing. Mr. Pearce was correct in putting the percentage of increase in the cost of high-pressure plant, in the neighbourhood of 350 lb., at 20 per cent. Up to 475 lb. that increase would not go up proportionately, as the temperature difficulty had been dealt with, and it was merely the pressure which had to be estimated.

Mr. Bircham thought they must expect some trouble if they took steps that were too big. Cast iron in an economiser at 350 lb. pressure was a thing he did not want to have much to do with, especially if superimposed upon a water-tube boiler. For these high pressures he strongly advocated that the economiser should be of steel. The expansion of feed pipes had a good deal to do with the trouble which had been experienced.

Mr. Shaw, in reply, held that the quantity of circulating water he had mentioned could be attained. The larger

quantity was quoted by condenser makers to give them a margin. Schedule I was only the cost of running a set, not the cost of running a power station. At the Connor's Creek station they got 1.42 lb. of coal per KW.-hour, the calorific value being 14,200 B.TH.U., which gave a consumption of 20,400 against his 23,110. He did not see why the larger boiler should be more efficient than the smaller boiler. A small furnace was easier to handle than a big one. The schedule gave 4,380 hours in a year if they ran at full load the whole time. He could quite easily take care of the longitudinal expansion in the steam pipes. His remarks with regard to the steel bolts *versus* wrought-iron bolts related to commercial wrought-iron bolts as sold, not to Low Moor iron.

TRAMWAY TRACK WATERING.

By H. P. M. D.

Now that so many of our tramway departments have reduced the number of motormen to the least possible, it has, in a great many cases, been found impossible to spare a driver to go out with the water cart, and it has, therefore, become necessary to find other means for the very necessary work of watering the track. The simplest means by which this can be done in those districts where the conditions of the track are such that suitable hills dominate large sections of the route—and these are found in a great number of

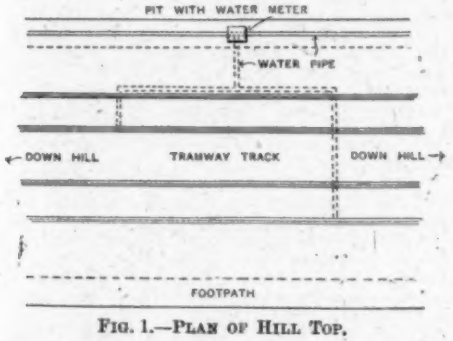


Fig. 1.—Plan of Hill Top.

our towns—is the method described below, which has met with considerable success on a system which the author has had under observation.

In fig. 1 a plan of the arrangement is shown; a suitable pit is built round the water main on the footpath, in which are placed a valve and a branch pipe running through a water meter. From this branch pipe are taken two sub-branches for feeding each set of rails, the water running down hill on

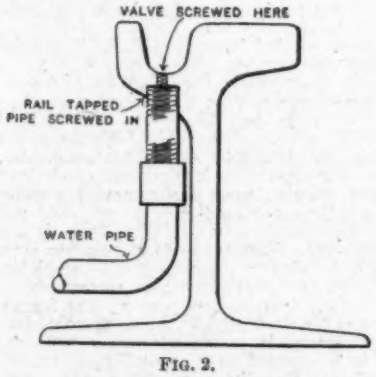


Fig. 2.

each track, through a hole drilled in the groove of the rail. The valve on the rail consists of a brass screw with one side filed with a flat, and a slight unscrewing of this allows the water to trickle through in just sufficient quantity to keep the track properly watered. This system needs very little maintenance, and is applied to the climbing sides of the track. Fig. 2 shows the method of fixing the pipe to the rails.

Another system which can be adopted, if the crest of the hill is sufficiently steep to get the necessary head of water, is to build in the footpath a small cistern with an overflow pipe at the top, as shown in fig. 3, and simply let the water siphon down into the rails; the outlet at the rail in this case is taken a few yards down hill, the distance being in accordance with the amount of fall necessary to give a steady flow of water. This alternative system has a considerable advantage over the system just described, inasmuch as the water is supplied to the rails at very little pressure, whereas with the first method the dirt which at times accumulates round the top of the screw will occasionally reduce the opening to such an extent as to cause the water to squirt out to a height of several feet, which is very undesirable; but it has been found in actual working that this does not occur very often, as the constant flowing of the water tends to keep the hole quite clear from all obstructions. With

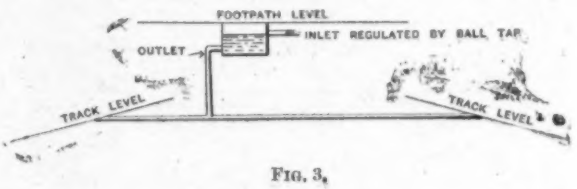


Fig. 3.

the second system the opening into the rail can be left much larger, so there is practically no trouble with obstructions. With this method of track watering it is found that very little water is required, as all the water is used usefully, and not, as in the case of a water tank, splushed out over the setts at the sides of the rail. Both these systems are, however, subject to the usual "human troubles" in the shape of small boys, who will interfere wherever possible. But, as in all such cases, the attraction soon wears off, and it is found that considerable lengths of track can thus be treated at a cost for water of only a few shillings per quarter, which is considerably less than the wages which would be paid to men for driving out a water tank. A survey of a great number of tramway routes would show that the greater portion of them could be treated in the manner described.

A BREWERY ELECTRIFICATION.

Messrs. Ansell's Brewery, Ltd., Aston, is one of the oldest establishments of its kind in the Birmingham district. In 1899 the firm first experimented with the electric drive, and also

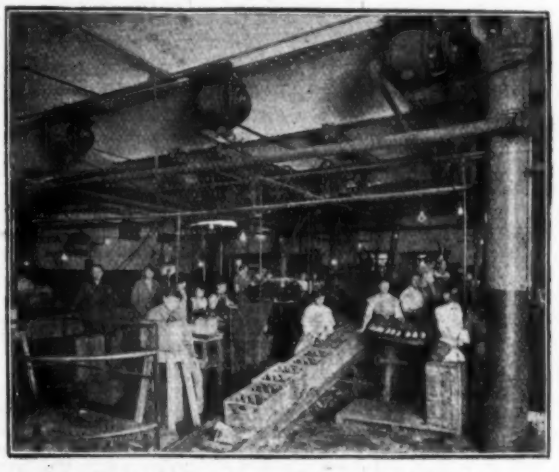


Fig. 1.—Group Drive in Bottling Stores.

installed a small lighting plant. Since that date the firm has consistently extended its installation, until to-day there is very little plant that is not electrically driven.

The electrification of a brewery calls for machines of no very great size. Most of the motors have outputs varying from 5 to 15 H.P., and rarely is a machine of any larger capacity wanted. Messrs. Ansells laid down their plant on the continuous-current system, and the switchboard distributing the power throughout the works is of the "Witton" type, each circuit being controlled by hand-guard fuses. The motors employed throughout the works are standard machines, and, with one or two minor exceptions, are of

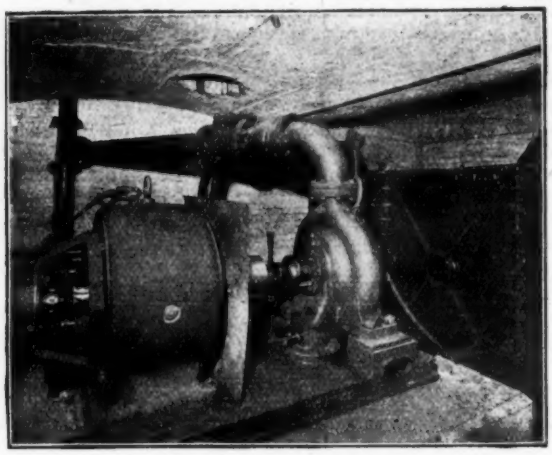


FIG. 2.—MOTOR-DRIVEN PUMP.

the General Electric Co.'s manufacture. Quite a large proportion of the load in the works takes the form of pumping, and centrifugal pumps are invariably adopted. In the pure-air plant room in the brewery there are a number of motors, averaging about 5 H.P. apiece, circulating the air through the fermenting rooms.

Electric motors of 5 H.P. are to be found driving pulp-cleaning machines, the pulp being used as a filtering medium in the production of chilled and filtered beers, and the yeast-drying machines. The grain driers (fig. 3), where the grains are passed through heating furnaces, are operated by 4-H.P. motors; 5-H.P. motors are used to circulate the brewing water in the brewery water tanks, and also for driving the malt blowers.

The bottling store is one of the most difficult places in the brewery to secure a satisfactory drive with individual machines. This is, however, desirable in some instances, and the motors must then be of the water-tight pattern, as the amount of liquid thrown about the place is considerable. In Messrs. Ansell's brewery the bottling machines are group-driven, as shown in fig. 1, the 6-H.P. motors being mounted on the ceiling.

FIG. 3.—MOTOR-DRIVEN GRAIN DRIERS.

The hoisting of the raw material about the works is carried out by electric hoists driven by motors of various sizes. A typical instance is a sack-hoist driven by a 7½-H.P. motor. In the stable equipment, dust extractors and chaff-cutters are electrically-driven as well. In fig. 2 is seen a motor-driven pump, which raises water from a well 563 ft. deep.

The installation aggregates some 520 H.P., there being 120 "Witton" motors in different parts of the brewery.

Thanks are due to Messrs. Ansells for permission to take the photographs and publish this description.

ELECTRICITY ON THE FARM.

THOSE who do not appreciate that the era of "electricity on the farm" is here are behind the times. We have only to look at the money that one American electrical company is spending on a farmer's electrical handbook, a finely-produced publication answering the farmer's questions about electricity, and a catalogue on electrical appliances and machinery applicable to farm use, and, again, at the Southern California Edison Co.'s expenditure of well over 5½ million dollars in 1917 to meet the demands of agriculturists. We cannot imagine that companies of this size would spend their money in such fashion unless they knew for a fact that it would pay.

According to the *Journal of Electricity*, electrical machinery, appliances, and supplies sold to farmers in California aggregate 15 to 20 million dollars annually. In December, 1915, a survey to determine the actual use to which electricity was being put on the farm showed that 14 companies supplied energy to 10,583 installations totalling 190,441 connected H.P. This means in round numbers about 200,000 H.P., which represents approximately 12,000 motors, of which 80 per cent., or 160,000 H.P. is for irrigation reclamation, and 20 per cent., or 40,000 H.P., for miscellaneous purposes. If this latter load is obtainable in such a widely scattered community as California, is it not possible that this character of load would be very much greater in a more densely populated community?

A small motor is an invaluable adjunct to the farm, and with the use of light-armoured cable and a safety-first switch can be moved from place to place where needed. In the same journal referred to above several interesting illustrations are given, one of which refers to a 5-H.P., 1,200-R.P.M., 60-cycle, 220-volt, 3-phase motor belted to a cross-cut circular saw. The owner has a small electrical distributing system on the farm which reaches the principal points, from

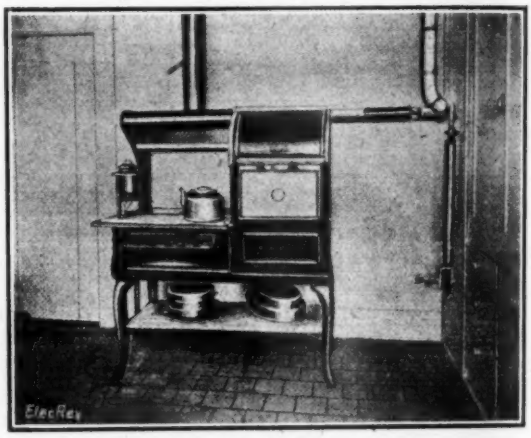


FIG. 1.—ELECTRIC RANGE ON A FARM.

which he then runs a temporary line to the spot where the motor is needed. Another interesting farm appliance is a semi-portable creek pumping plant. A 15-H.P., 1,800-R.P.M., 220-volt, 3-phase, 60-cycle motor is belted to the pump, which runs 10 hours a day, costing less than $2.0, and pumping enough water for two acres. When flood waters come the owner takes the pump and motor out of the creek and stores them in his barn.

Electricity is needed in connection with practically all the modern improvements on the farm. A 50-H.P. installation mentioned is used mostly for irrigation purposes, but there is also a small refrigeration plant, and motors are used for driving feed cutters, &c. The use of electric lighting in the barn is easily understood, together with the ease with which electric drive is applied to the needed machines.

The encouragement and development of electricity in agricultural and dairying work should not be a difficult matter, where there are many new uses to which it could be put. Wherever there is a gas or oil engine there is a prospect for an electric motor. Farmers in California use electrical appliances, such as electric ranges, irons, percolators, toasters, washing machines, sewing machine motors, &c., more generally and readily than do city people. The farmer is indicating his desire for electricity by the large sales of farm-lighting sets which several large manufacturers have shown. The fact that it is reported they are selling 75 or 80 equipments a day indicates that the rural communities are anxious to have electricity. That a very large percentage of California houses are using electrical appliances is evidenced by the following annual sales in California:—Irons, 17,000; toasters, 2,700; percolators, teapots, &c., 6,700; portable vacuum cleaners, 5,500; washing machines, 5,000; cooking ranges (estimated), 1,500. In addition, small motors are purchased for driving sewing machines, &c. In the kitchen, where heat is required in varying quantities throughout most of the day, the advantages of the electric range are being rapidly appre-

ciated. The women on the farms seem to appreciate the electric range even more than do those in the city.

Fig. 1 shows an actual installation in a ranch at Sunnyvale, California, where, with the range and a 3,000-watt water heater, electricity bills average $5.75 per month. Some time ago there were 1,750 electric ranges in use in California homes. This phase of the business is barely in its infancy, and if in a couple of years the public sees its way clear to purchase this number of ranges, it is not so difficult to imagine the amount of range business which is awaiting the manufacturer in the next few years.

A great effort is being made to increase the output of the rice fields of Arkansas in order to save wheat, says the *Electrical World*, and electric pumping for irrigation purposes is making great headway. The local company is supplying electricity for this purpose to 48 rice farmers near Pine Bluff. Rice crops need an almost continuous supply of water, from the time the rice is a few inches high until it is ready for harvest; in Arkansas artificial irrigation methods are necessary for 90 to 120 days in the year. The power for this irrigation work is supplied from 40 miles away by three-phase, 33,000-volt transmission, distributed at 6,600 volts, and finally stepped down to 220 volts for use at the motors, which average 60 H.P. each. The consumption this season is expected to reach 40,000 to 50,000 KW.-hours.

According to *Der Ingenieur*, which reports a lecture by Mr. A. W. C. Dwars dealing with drainage of marshes, electric pumping machinery has several advantages for such work. The level of the sub-soil water in the marsh can be effectively controlled, and the cost of electrical methods is not excessive.

The standard three-phase, motor-driven centrifugal pump is specially adapted to drainage work. Tests over 13,600 acres showed an excess in cost for electrical pumping of only £72 per annum—about 1¼d. per acre—as compared with the very cheapest methods available. This estimate assumed a not very favourable cost for electric energy, and in any case the small margin in cost is of small account compared with the much greater reliability of electrical methods. The author thinks that there is a great future for electric drainage of marshes in Holland; there are, however, considerable opportunities for improvement in the overall efficiency of electric pumping stations, which is not too high.

LEGAL.

ELECTRIC LAMP RE-FILLS.

IN the King's Bench Division on Monday, Mr. Justice Darling sitting without a jury had before him an action brought by the Electric and General Stores Co., carrying on business in the electrical trade at Newcastle, against the Anglo-Continental Sales Co., carrying on business in the City of London, to recover damages for alleged breach of contract. Defendants did not appear.

Plaintiffs' counsel said the defendants contracted to supply them with a large quantity of electric light re-fills. The first instalment was to be a lot of 20,000, and payment was to be at the rate of £23 per thousand. The date of the contract was May 15th, 1916. When the goods were delivered it was found that not a single re-fill came up to the specification. Plaintiffs, therefore, suffered damage, for they paid £460 and lost the profit which they otherwise would have made.

MR. J. WM. DODDS, partner in the plaintiffs' firm, gave evidence to the foregoing effect, and MR. W. T. MUNDELL (in the plaintiffs' employ) and MR. JOHN BRUCE BRANTING, of Sunderland, spoke to examining and testing the re-fills.

His LORDSHIP gave judgment for plaintiffs for £460 and for £490 damages.

WORKMEN'S COMPENSATION CASE.

JUDGMENT was given in the Court of Session, Edinburgh, in an appeal in which Thomas Logan, brought under review a decision by Sheriff Substitute Lee, at Airdrie, fixing the amount of compensation to be paid under the Workmen's Compensation Act to the pursuer, who was injured while employed by the Shotts Iron Co., Ltd., as an electrical coal-cutting machine contractor.

The DEFENDERS admitted liability, and paid compensation down to August, 1917, when the pursuer partially recovered, and took employment as a check weighman, with the wages possible to him of £4 4s. a week. In January he made the present claim, and said his average weekly wage as a mining contractor prior to the accident was £5 8s. He was still partially incapacitated.

The DEFENDERS maintained that the contract was composite, and that a distinction must be drawn between what he earned as a workman at the coal face and the profit he made out of his business relation with them as a contractor.

The SHERIFF-SUBSTITUTE held that this was something more than a contract of service, and the pursuer's income for the year from the whole transaction represented something more than his earnings as a workman. He accordingly assessed the compensation, on the footing that the pursuer's earnings were £220 a-year, at 5s. to July, 1918, and thereafter at 6d. weekly.

The Court of Session held (Lord Skerrington dissenting) that the matter had been rightly decided by the Sheriff, and found pursuer liable in expenses.

BUSINESS NOTES.

Our Letters from the Forces.—A Corporal in the R.E. writes:—"I have pleasure in thanking you for the regular receipt of the ELECTRICAL REVIEW during the past year. During my four years in France with the Infantry and Engineers you have sent me your paper unfailingly, and to say I am grateful is not sufficient—I feel under a deep obligation to you. I must say a word, too, in appreciation of your most excellent leading articles. I only hope they are read by those in authority both in the electrical and political worlds."

"Magnet" Football Club.—This club has been formed by the Commercial Apprentices of the GENERAL ELECTRIC CO., LTD. Mr. H. Hirst is the president, and the ground is at the Borough Polytechnic, Turney Road, Dulwich, S.E. We have received a copy of the fixture card for the 1918-19 season. Six matches have been played already, with fair success. On Saturday last the club played the Waygood A.A. (Waygood-Otis) at Bellingham, and on a heavy ground succeeded in defeating them by 2 goals to 1. Goals were scored for the "Magnets" by Sansom and Curtis, and Fuller played exceedingly well at right half.

Relaxation of Export Restrictions.—Certain relaxations with regard to the existing prohibitions against the exportation of electrical materials are announced by the Board of Trade. Thus magnetos and sparking plugs have been removed from List A to List B, and searchlight carbons and carbon electrodes for electric furnaces from List A to List C. Under List A exports to all destinations are prohibited, under List B, to all destinations outside the British Empire, and under List C shipments only to countries neighbouring enemy countries are prohibited.

Iron and Steel Prices.—*Pig Iron Prices.*—The Minister of Munitions gives notice that he is fixing export prices of pig iron applicable to all exports of pig iron on and after December 2nd, 1918, until further notice. The existing maximum prices of pig iron for home delivery remain in force until further notice.

Steel Prices.—The Minister of Munitions gives notice that he is fixing new maximum prices of steel for delivery in the United Kingdom on and after February 1st, 1918. Until that date the existing maximum prices remain in force.

Bar Iron Prices.—The Minister of Munitions gives notice that he is fixing export prices of bar iron applicable to all exports of bar iron on and after December 2nd, 1918, until further notice.

Particulars of the above may be obtained on application to the Ministry of Munitions (C.I.S.P.), Room 104, 8, Northumberland Avenue, W.C. 2.

During the war, while the Government was practically the sole purchaser of iron and steel products, the Ministry of Munitions adopted the policy of stabilising prices in the iron and steel industries by paying direct to the makers certain increased costs due to war conditions.

Now that the Government is no longer the sole purchaser, it is desirable to place the industry on an economic basis as early as possible, but the great increase in prices which would result from an immediate withdrawal of all subsidies would seriously prejudice the resumption of ordinary commercial work, and induce dislocation not only in the iron and steel trades, but in the wide field of engineering and other activities dependent on iron and steel.

The Government has, therefore, decided to remove the subsidies in two stages. Those applicable to steelmaking will be removed on January 31st, 1919, when a revised schedule of maximum prices for steel will take effect. Those applicable to pig iron will continue to April 30th, when it is proposed that all subsidies should cease entirely. This will involve a further re-adjustment of steel prices, but post-war conditions are not yet sufficiently stable to warrant the fixing of prices after that date.

Arrangements have been made in consultation with the trades concerned to secure an equitable distribution of pig iron and steel so long as any subsidies continue. The powers possessed by the Government under the Defence of the Realm Act will, if necessary, be exercised to prevent any undue holding of subsidised material.

It is not, however, intended that Government subsidies should be used to enable exports to be made to oversea markets at less than the full cost. The Ministry has, therefore, issued lists of export prices for both iron and steel calculated to include the full amount of the subsidies. The Government will levy, as a drawback on exported iron and steel, the difference between the home and export prices.

Book Notices.—"The Excess Profits Duty." By E. E. Spicer and E. C. Pegler. Pp. 220. London: H. Foulks Lynch and Co. Price 10s. 6d. net.—This is the fourth edition, revised and brought up to date, of a useful publication, containing information which will be needed by taxpayers for a long time to come after the declaration of Peace. It includes the provisions of the Finance Act, 1918.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII, No. 11. November, 1918. New York: The Institute. Price $1.

"The Business World." Vol. I, No. 6. August, 1918. Madras. Price 8 annas.

Trading with the Enemy.—The *London Gazette* for November 29th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina and Uruguay, Brazil, Ecuador, Haiti and Dominican Republic, Mexico and Spain.

Agencies Wanted.—The Secretary of the British Chamber of Commerce of Sao Paulo reports that a firm of importers of electrical specialities and machinery desire to act as exclusive agents for U.K. manufacturers of these goods. Reference No. 365. Particulars from Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Coventry Ordnance Works.—At a special meeting of debenture stockholders in the FAIRFIELD S/B AND ENGINEERING CO., LTD., called for December 9th, proposals will be considered for the sale of shares in the Coventry Ordnance Works, Ltd., and for the sale of the assets of the Coventry Works to a new company, and respecting amalgamation of the Coventry Works with Dick, Kerr & Co., Ltd., and Phœnix Dynamo Manufacturing Co., Ltd.

Catalogues and Lists.—HANS RENOLD, LTD., Didsbury, Manchester.—A useful pamphlet (No. 200/1) giving illustrations, prices, and notes on the selection of and hints upon the erection and care of chain gear.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham. —24-page illustrated catalogue of Simplex industrial lighting fittings for street, railway, factory, shop, and other illumination. Prices are given.

VISLOK, LTD., 3, St. Bride's House, Salisbury Square, E.C. 4.—Descriptive pamphlet on the Vislok self-locking nut, with many testimonials.

THE WARDLE ENGINEERING CO., LTD., 196, Deansgate, Manchester.—Catalogue No. 11, which, in addition to giving full particulars and prices of the Wardle lanterns, reflectors, and other fittings, contains an excellent section on the theory and practice of illuminating engineering, and gives prices in shillings and decimals of a pound, in anticipation of decimal coinage and to facilitate conversion to any decimal coinage; the English weights are stated entirely in lb., and the metric equivalents for weights, dimensions, and volume are included. Code words are provided for all items. The catalogue is intended to be useful to all traders at home and abroad, as well as to the light-user himself, and is a model of its kind.

AUTOMATIC AND ELECTRIC FURNACES, LTD., 6, Old Queen Street, S.W. 1.—Heat Treatment Bulletin No. 5, on the practical checking of pyrometers; an ingenious method of using the magnetic change-point of iron, as indicated by the Wild-Barfield system, is described, which facilitates the checking of thermo-couples at the temperature of 768° C.

Liquidations and Dissolutions.—BRITISH ELECTRON CO., LTD.—Winding up voluntarily for the purpose of reconstruction. Liquidator, Mr. S. Lingard, of Manchester. Meeting of creditors, Manchester, December 11th.

VULCO MAGNETO CO., manufacturers of magnetos, 11, Long Acre, E.C.—Messrs. D. A. V. Rist and H. Rothwell have dissolved partnership. Debts will be attended to by Mr. H. Rothwell, who will continue the business.

TOWNSON & FAIRHURST, electrical engineers, 118, Bark Street, Bolton.—Messrs. E. Townson and E. Fairhurst have dissolved partnership. Debts will be attended to by Mr. E. Townson, who will continue the business.

Removal of Restrictions on Non-Ferrous Metals.—The Ministry of Munitions announces that in the disposal and allocation of stocks of non-ferrous metals in its possession to consumers, it will be prepared to pay brokers and recognised intermediaries a commission of ½ per cent., subject to cash payment for the material.

Trade Announcements.—THE STANTON IRONWORKS CO., LTD., has opened a branch office at Manchester at Grosvenor Chambers, Deansgate, under the management of Mr. G. W. Turner; all matters relating to pig iron, cast-iron pipes, special castings, ironstone and slag sales in that district will be conducted from that office. Telephone, 4945 City; telegraph, "Spigot, Manchester."

MESSRS. NAPIER-KIMBER, LTD., say they have been appointed sole selling agents for Lancashire and Yorkshire for the Associated Battery Co., of London. All communications and inquiries to be addressed to St. George's Hall, Bradford.

Bankruptcy Proceedings.—E. HODGSON & SONS, engineers, Cleckheaton.—First meeting, December 11th. Public examination, December 18th, both at Bradford.

C. O. UNER, engineer, Bolton.—Third dividend of 5s. in the £, payable December 13th, at 27, Brazenose Street, Manchester.

The public examination was held on December 3rd, at the London Bankruptcy Court, before Mr. Registrar Mellor, of EDMUND CHARLES SPARKES, electrical manufacturers' agent, 118, Wardour Street, W., who returns liabilities £352 14s. 9d. and assets valued at £1 1s. 3d. In reply to the Official Receiver, debtor said he commenced business in 1906, under the style of Sparkes & Co., with a capital of £200. The rent of the premises was £165, rising to £180 per annum. He acted at various times as agent for Messrs. H. Davis & Co., Ltd., Birmingham; Messrs Peyton & Peyton, Birmingham; Messrs. S. N. Woolf & Co., Weevelinghoven, Germany; Messrs. Samuel Heath and Son, Birmingham; and Messrs. J. and W. Stokvis, Arnhem, Holland. When the war broke out in 1914, he held the last two mentioned agencies, and that of Messrs. Stokvis was immediately terminated, but he retained that of Messrs. Heath & Son until September, 1915. Witness attributed his failure to the outbreak of hostilities and the consequent termination of his agencies and restriction of trade. The whole of his liabilities were for goods supplied for trade purposes. His drawings for household and personal expenses averaged £5 weekly. The examination was concluded.

LIGHTING AND POWER NOTES.

Accrington.—PROPOSED NATIONAL E.S.—The Electricity Committee has passed a resolution disapproving of the recommendations of the B. of T. Power Supply Committee, particularly the suggested terms of purchase of generating stations by the State. The Committee expressed the view that no Bill would be acceptable which did not give municipalities the option of retaining ownership and control, and an exhaustive inquiry was called for by an unbiased and impartial Parliamentary Committee.

PRICE INCREASE.—From the end of the current quarter the Electricity Committee is increasing the charges for electricity by a further 10 per cent., making a total of 20 per cent. over pre-war charges.

Argentina.—STRIKE.—At the beginning of October a strike of the employés of the German Electricity Co. occurred. In anticipation of the strike, the company engaged about 300 men to replace the strikers, and, later, 600 substitutes were employed. Some cables were cut, but no serious interruption of the lighting service took place. A large proportion of the substitute workmen were Germans and Turks. Some shots were fired in the streets, and a police guard of 120 and 50 mounted men kept order at the power stations.—*Review of the River Plate.*

Ashton-under-Lyne.—SHOP-WINDOW LIGHTING.—Sir Albert Stanley, President of the Board of Trade, announced to a deputation of shopkeepers at Ashton-under-Lyne, on Wednesday, that shopkeepers would be allowed in the immediate future to have as much light as they liked in their windows, provided they kept within their rations.

Ballymoney (Co. Antrim).—PROPOSED E.L.—A local company has been formed for the purpose of installing an electric light and power station in the town.

Barrow-in-Furness.—EXTENSIONS.—The Electricity Committee has entered into agreements for the supply of electricity to the carriage and wagon works and engine-shed of the Furness Railway Co., the works of the Barrow Hematite Steel Co., and the new works of Messrs. Ward. The necessary switchgear and transformers are estimated to cost £1,500.

BATTERY MAINTENANCE.—Applications from the Tudor Accumulator Co. and the D.P. Battery Co., requesting the revision of their agreements, have been referred to the Lancashire and Cheshire Association, with a view to uniform terms being obtained for the various undertakings affected.

Bolton.—PRICE INCREASE.—The following increases will be made in the electricity charges from the commencement of the current quarter:—Ordinary or power consumers, '15d. per unit; lighting consumers, '35d. per unit; special power consumers, 7½ per cent. on existing prices; bulk consumers, '015d. per unit.

Bootle.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity for lighting and power from 30 per cent. to 40 per cent. over pre-war rates, and in cases where the charges are adjusted according to the price of coal, by a further 2½ per cent., making 15 per cent. over pre-war rates. The increases are to take effect from the end of the year.

Continental.—SPAIN.—Our Special Correspondent in Spain writes as follows:—

"Among recent water-power concessions are the following:—The Bores Tobalina Co. has been granted powers to use a waterfall on the River Ebro, in the district of Miranda de Ebro, giving 20,000 litres per second during the eight months from November to June inclusive, and 10,000 litres per second during the four months of drought. There is a useful head of 8 metres, so that 1,700 H.P. will be available nearly all the year round. The Vasco Alavesca Co. has been given permission to enlarge its existing hydro-electric plant up to 10,000 litres of water per second, at a useful head of 2½ metres. The Huici y Pajares Co., of Pamplona, has been granted the use of 3,000 litres per second on the River Najerilla, for the production of electricity.

"Messrs. Pendis & Cernuda, of Villamayor, have applied for the use of 1,000 litres per second on the River Color (Pilona), at a useful head of 39 metres.

"Don Armando A. Pumarino has applied for permission to use 10,000 litres per second from the River Aller, to construct a dam, two tunnels, and a siphon, and to erect a central station for the production of electricity.

"The Compania Catalana de Gas y Electricidad, of Barcelona, has just inaugurated its power plant at the Rum Falls, on the River Esera, and has also erected a transmission line 225 km. long. The energy generated is transmitted to distributing stations at Tarrasa, Sabadell, San Adrian, and Barcelona. Now that this central station is completed, the company will be able to make more rapid headway on its second plant—Puente Argnoé—on the same river. It is hoped to finish this second plant during the coming winter, which will bring the total energy installed by the Catalana Co. in the Barcelona district up to 50,000 H.P. The company is still further extending its generating capacity, and has lately placed a contract with Messrs. Piccard, Pictet & Co., of Geneva, for a 4,250-H.P. turbine and one of 2,800-H.P. capacity.

"A new central station for the supply of energy for lighting purposes has recently been started at Camicosa de la Sierra (Burgos).

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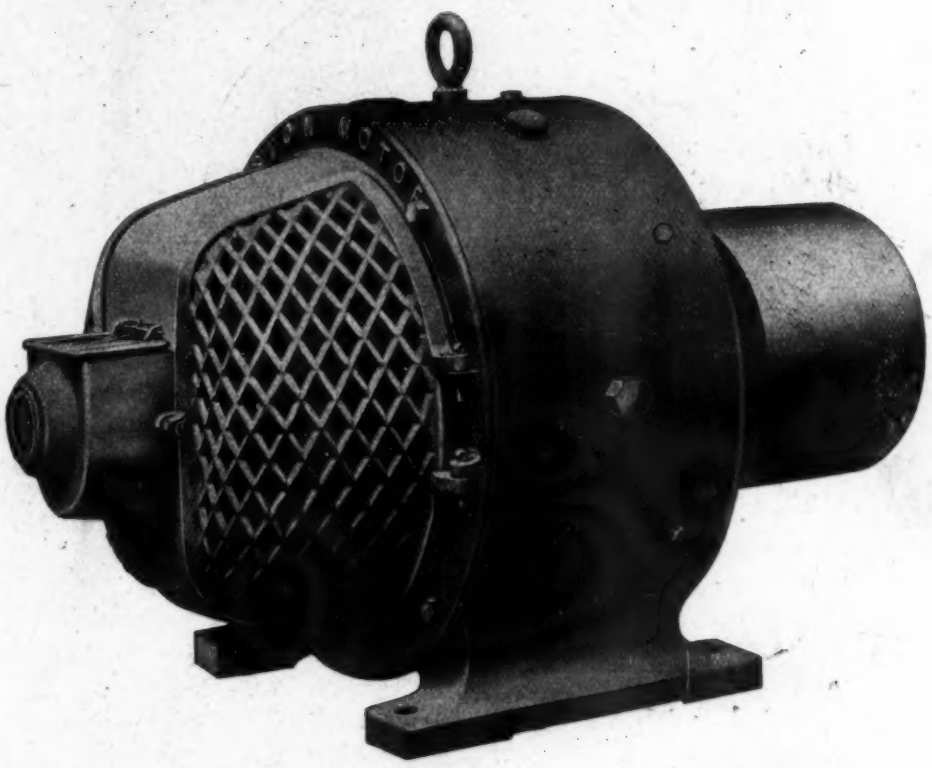

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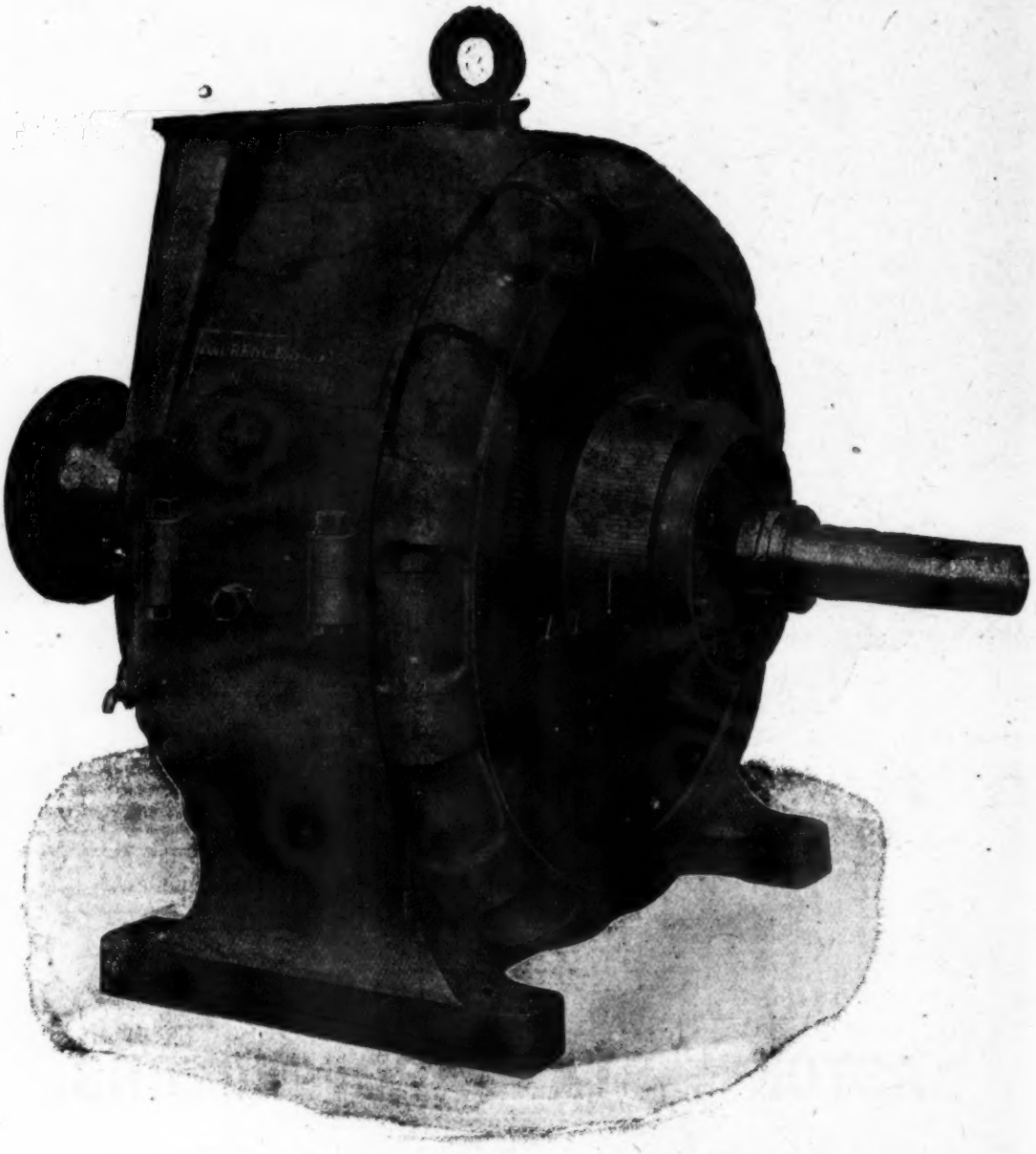

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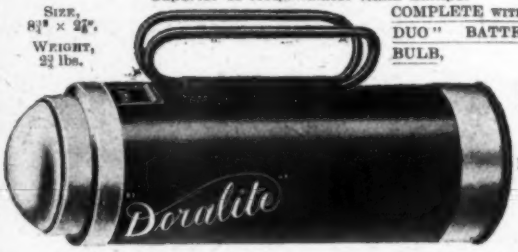

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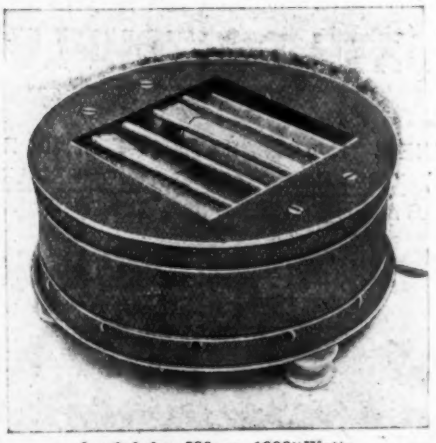

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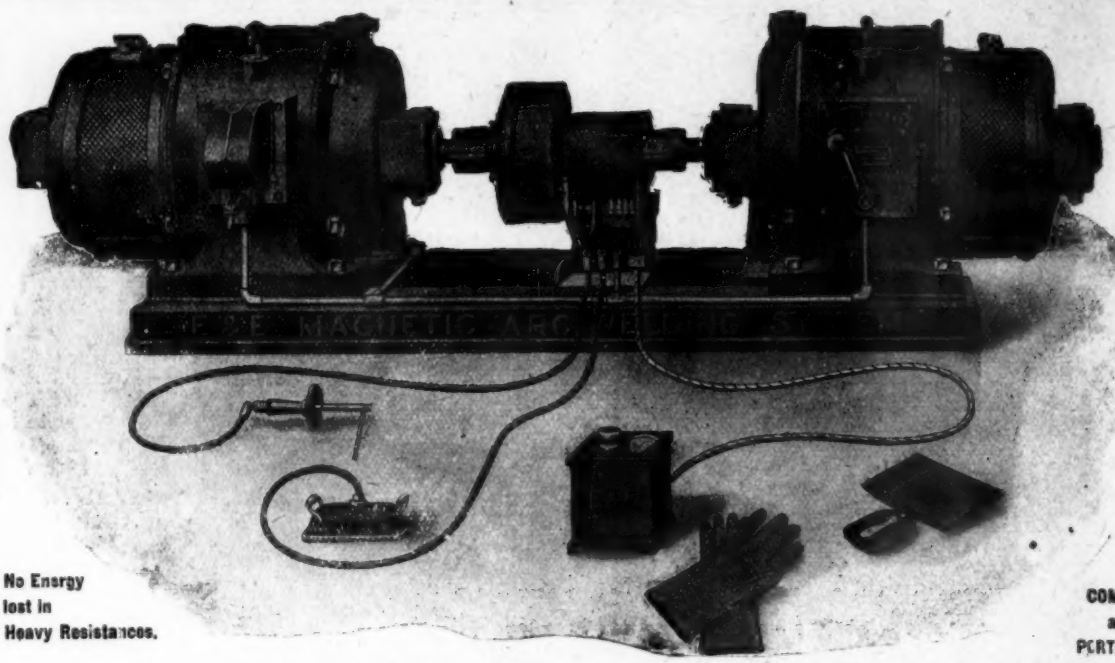

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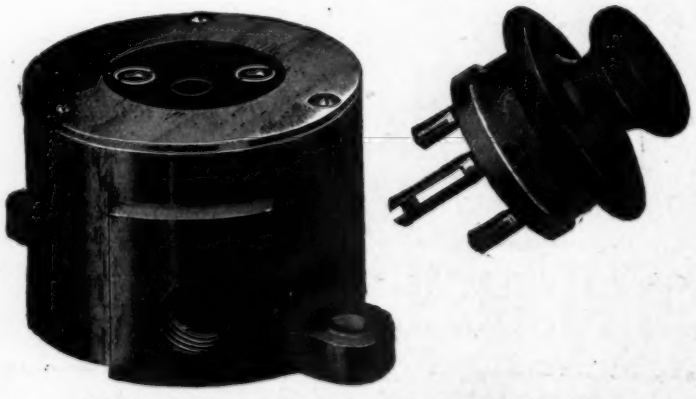

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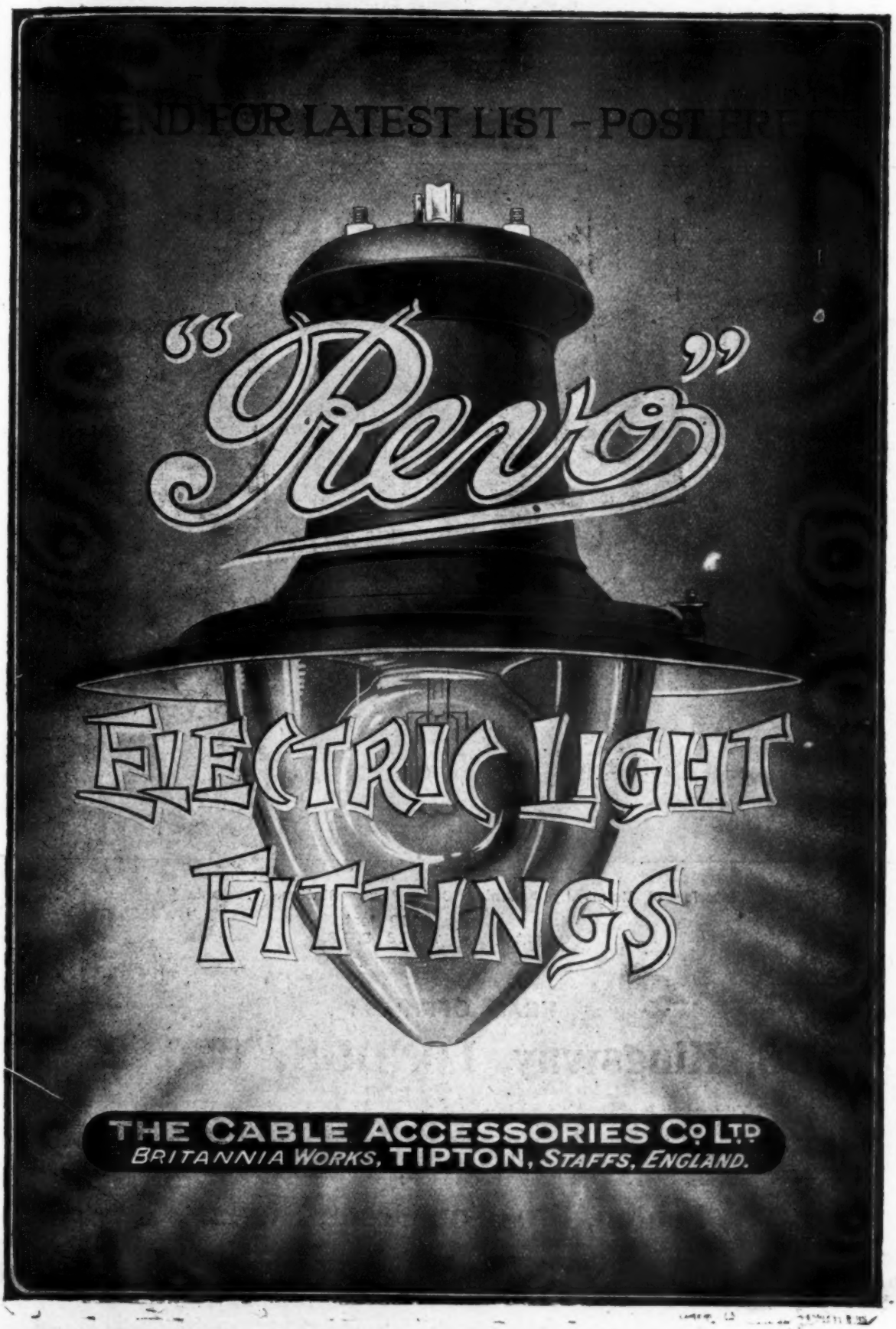

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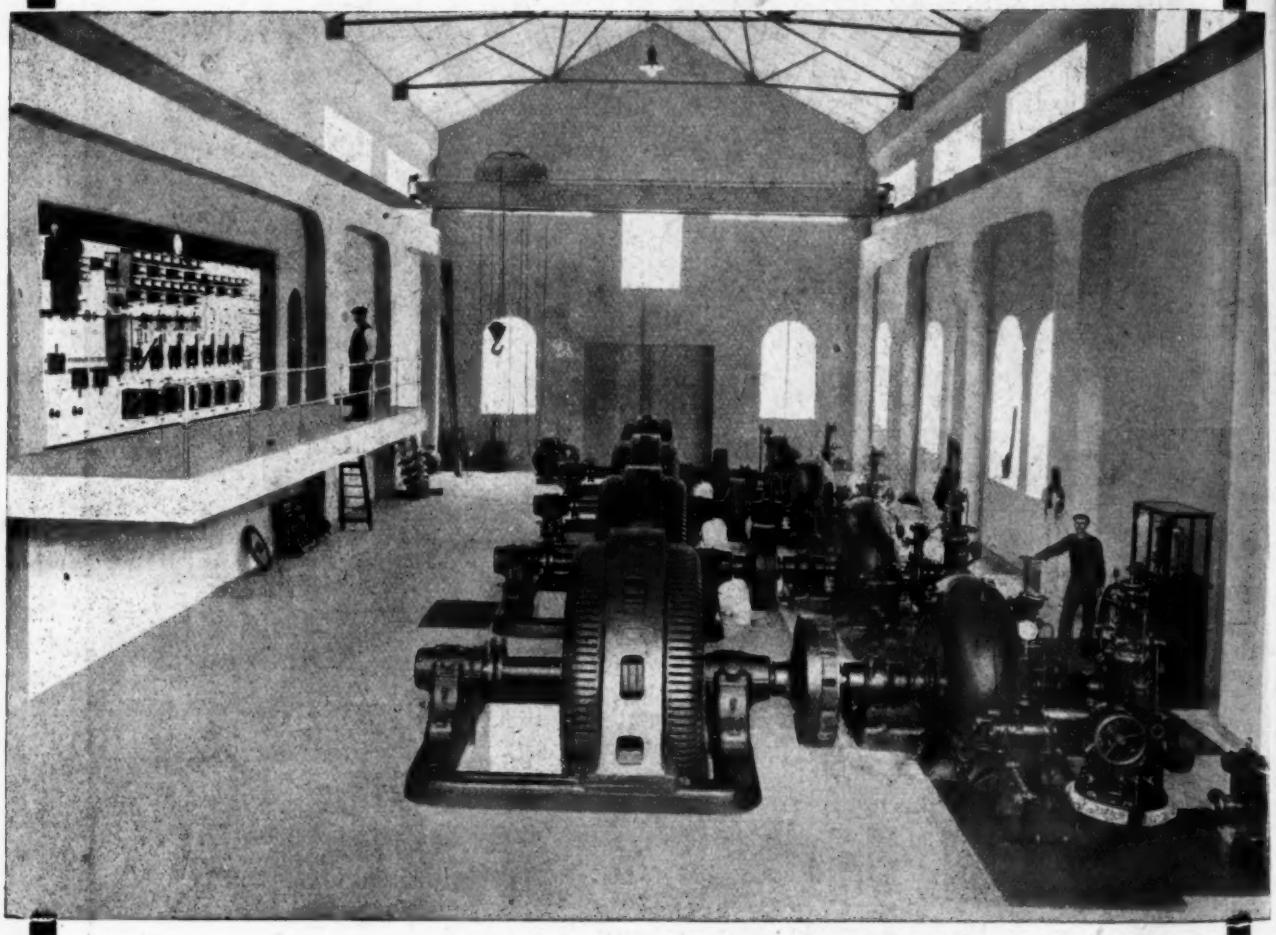

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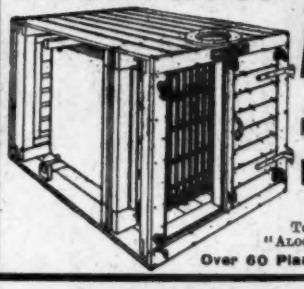

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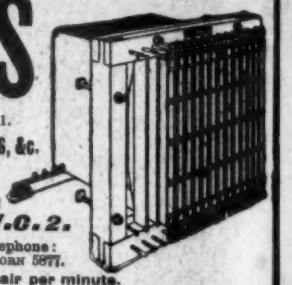

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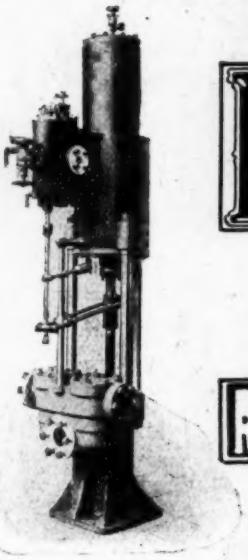

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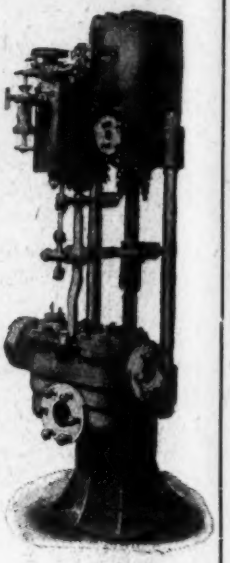

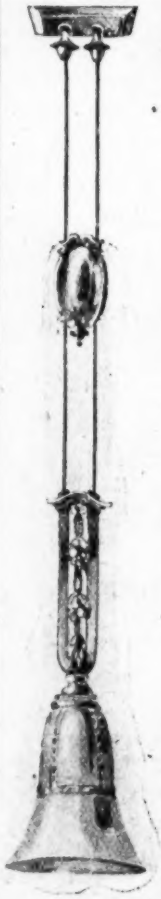

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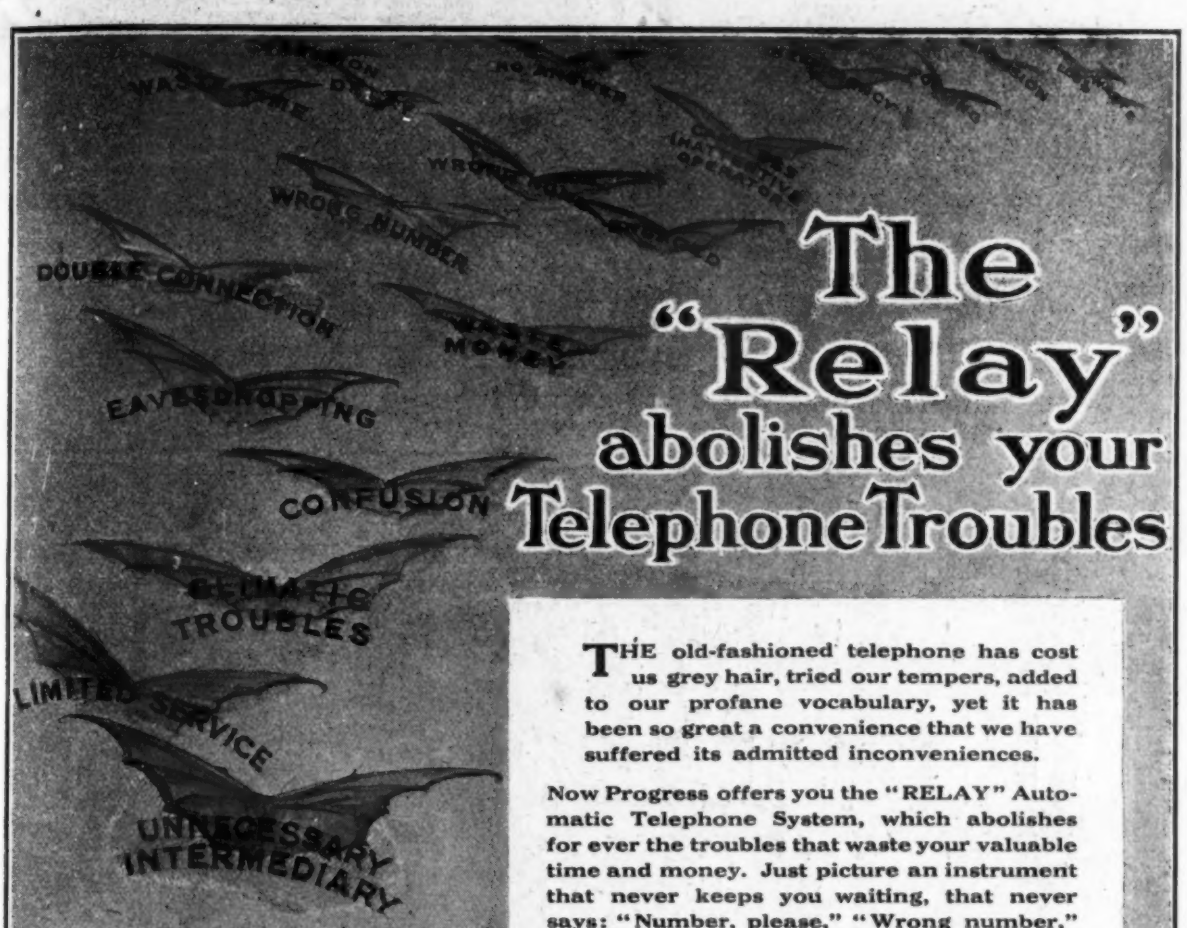

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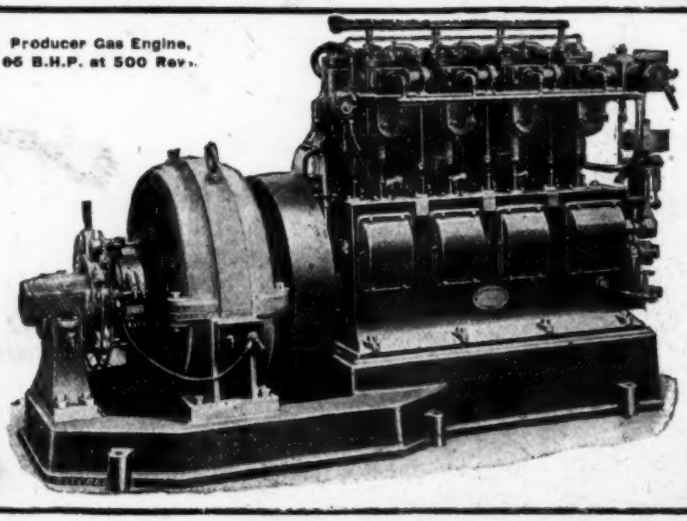

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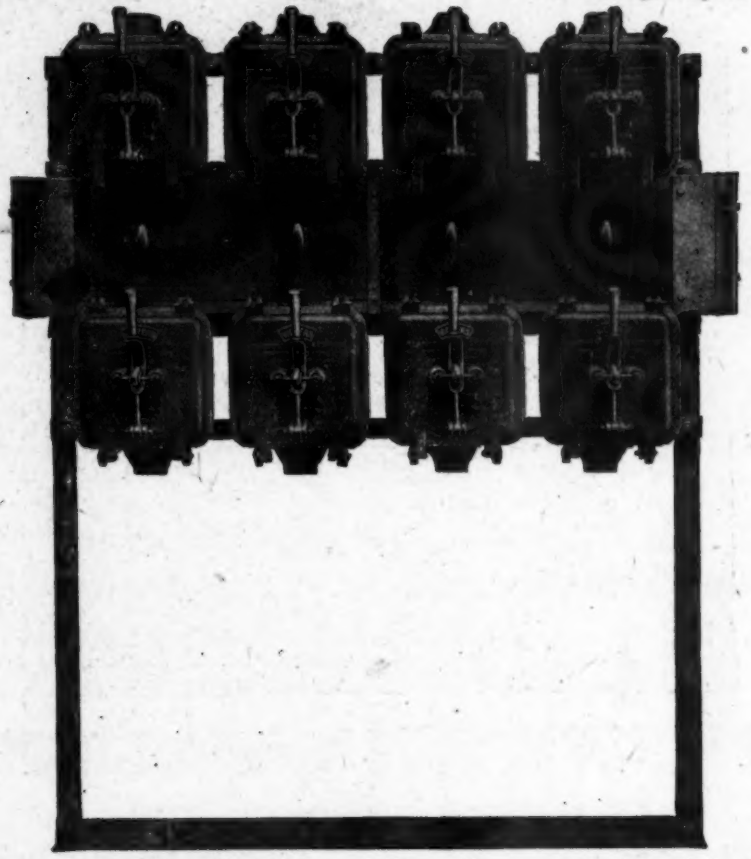

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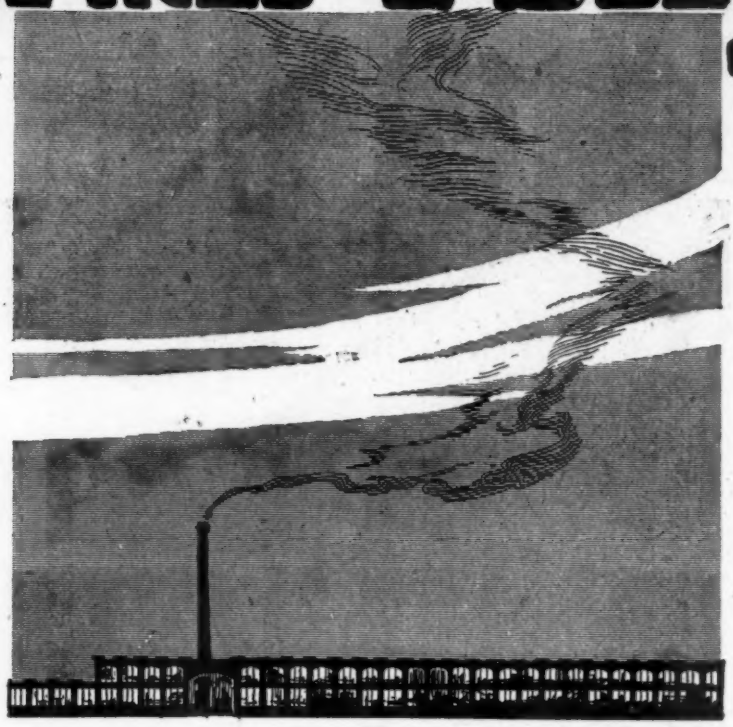

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(Continued on next page.)

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(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

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DRAUGHTSMAN wanted, capable junior.—6270, ELECTRICAL REVIEW, 4. Ludgate Hill, London.

DRAUGHTSMEN (including head for drawing office of 20), experienced in electrical starters, required immediately for after-war work; London district. — 6230, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN.—Permanent progressive positions offered to capable men with knowledge of cable accessories, junction boxes, fuseboards, street pillars, &c; works near Liverpool.—State age, experience and salary required, 3376, ELECTRICAL REVIEW, 4. Ludgate Hill, London.

DRAUGHTSMEN wanted for traction motors and equipments, generators and turbines for works in north-west.—Apply, stating full experience, age and salary required, to 3312, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRIVER required at once in suburban station. Belliss and Willans engines. 56-hour week. Wages 9½d. plus 23s. 6d., plus 12½%.—Apply, stating experience, age &c,, to 6312, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMO Testers, with previous experience, wanted for A.C. and D.C. machines for heavy output. Manchester district.—State age, experience and salary required, to 3490, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, as Junior Traveller for London District, to represent Electrical Manufacturers. Must be well acquainted with London electrical trade, and must have good knowledge of D.C. plant and accumulators. Salary £200 per annum.—State age, experience to 3438, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, experienced in the design of electrical measuring instruments, and capable of taking charge of the engineering and designing section of a department engaged in the manufacture of such apparatus, wanted by large firm in the North. No one already on Government work will be engaged.—Apply to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6374. and stating age, experience and salary required. 3274

ELECTRICAL Estimator wanted, thoroughly reliable man, thoroughly conversant with A.C. and D.C. switchgear.—Apply WHIPP & BOURNE, LTD., Castleton, near Manchester. 3419

ELECTRICAL Fitter and Wireman required for theatre in provinces. Only fully qualified mechanic with undeniable references need apply.—3462, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Fitter, used to maintenance and upkeep of motors, control gear, &c. Permanent situation in S.E. London.—Write, stating age, experience and wages required, to I. L., c/o Streets, 30, Cornhill, E.C. 3. 3409

ELECTRICAL (Scientific) Instruments. — Skilled Test-room Assistants required; preferably technically trained men with shop experience on high grade instruments.—PAUL ELECTRICAL LABORATORY, Fortis Green Road, Finchley, N. 2. 6141

ELECTRICIAN and Fitter for maintenance of machinery and motors. Competent to do all repairs. Within 20 miles of London.—Full particulars as to experience and wages required, to 6305, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

ELECTRICIAN-Wireman wanted, used maintenance and repairs, lighting, telephones, bells, &c.—COLLEY, 51, Great Ormond Street, W.C. 1. 6272

ELECTRICIANS wanted, permanent work at union rates to suitable men.—VERNON HILL, Broadstairs, Kent. 6190

ENGINE Driver for Suction Gas Engines, one used to vertical engines preferred; 56 hours at 1s. 2d. per hour. Two shifts. —ENGINEER, Electric Supply, Ammanford, Carmarthenshire. 3327

ENGINE Driver wanted for shift in London power station, with turbine experience preferred. 9½d. plus 23s. 6d. plus 12½%. State qualifications to 3457, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER wanted for small tramway system in the North, as Assistant-in-Charge of permanent way, cables, overhead and sub-stations.—Apply, stating qualifications and salary expected, 3456, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER'S Draughtsman required to prepare Working Drawings for electrical and mechanical apparatus. State experience and salary required.—GIRLING, Electricity Works, Maldon, Essex. 3437

ESTIMATING Clerk required by a firm of Cable Manufacturers in London. Must be neat and accurate.—Apply, stating experience, age and salary required, to 3464, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTIMATING Engineers and Commercial Representatives for electric lifts and cranes required by a leading London engineering firm; excellent prospects for first-class men.—3465, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ESTIMATORS wanted, accustomed to high and low-pressure switchboards, Manchester district. State age, experience and wages required.— 3500, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Estimating Engineer required by leading manufacturing company.—Apply, giving experience and salary required and when at liberty, to 3343, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER wanted for Electricity Works in outer London district. Accustomed to overhaul and maintenance of turbine and reciprocating engines and water-tube boilers. Permanent job to competent and steady man. A.S.E. rates paid, plus awards.—Apply, stating age and particulars of experience, to 3316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER-Driver for country central station. Diesel and gas engines. Good wages to capable man.—Applications, stating wages required and accompanied by copies of three recent testimonials, to 6303, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FITTER-Driver required, used to running and upkeep of suction gas engines and suction gas plant.—State wages and experience, STRATFORD-ON-AVON ELECTRICITY CO., LTD. 3442

FOREMAN Armature Winder wanted for works in Glasgow manufacturing A.C. and D.C. motors and having large repair business; good prospects for man able to get the best results from workers.—State fully experience, with references, age, wages, 6297, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

JOINTER-Wireman required; one used to V.B. and paper-insulated cables and installation work.—State wages and experience, STRATFORD-ON-AVON ELECTRICITY CO., LTD. 3440

LARGE dynamo firm, not in Manchester or the Midlands, requires immediately two Assistant Electrical Designers, one familiar with alternate current machines from 100/600 H.P., and the other familiar with direct current machines over the same range. No person without experience over the above range machines need apply.—State in confidence, experience and salary required, to 3436, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LONDON Firm of Aircraft Engineers, making metal fittings for aeroplanes, is desirous of changing over their factory on to production of metal work for domestic architecture, and wants thoroughly capable Works Manager, with plenty of good ideas and initiative, having had previous experience before the war, of production of this class of work. Applicants must state explicitly their previous experience, and what in favour of producing, salary required, &c. Plants consists of press tool plant, bending machine, capstan lathes and other equipment.—3447, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER wanted, competent, good organiser, disciplinarian, interviewer and salesman; experience in factory electrical accessories an advantage.—Write, stating experience, age and salary required, to 6275, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MANAGER, with thorough technical knowledge, wanted for small well-known switchgear works.—Reply, giving experience, and stating salary expected, to Box 157, Sells, Ltd., 168, Fleet Street, E.C. 4. 6232

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

MANAGING Engineer required for Public Electric Supply Undertaking; Diesel and steam plant, total 330 KW.—Write particulars experience, salary required, to BOX A, Electrical Press, Ltd., Fisher Street, Kingsway, W.C. 3410

PLUMBER-Jointer required by Electric Supply Undertaking in the Midlands. Good E.H.T. jointer. Permanency.—Apply, stating age, experience and wages, to 3460, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REQUIRED, Foreman of electro-nickel plating, acid cleaning and metal polishing department. Must be capable of making up vats for white and black nickel plating, dull bronzing, &c., and able to control male and female labour. No person already engaged on Government work need apply.—Please state age, experience and salary required, to Box 162, Sells, Ltd., 168, Fleet Street, E.C. 4. 6235

REQUIRED, Telephone Faultsmen and Installers with intercom. experience. Good wages for good men. Permanency.—Apply between 9 and 10 any morning to I. T. C., LTD., 147/149, Great Portland Street, W., 1. 3397

REQUIRED, Traveller, with experience, for London district, for wholesale house of electrical accessories and fittings.—3415, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

RESIDENT Engineer wanted immediately for electric light station, seaside town South Coast. Salary offered £200 per annum, plus commission. Applications strictly confidential; disability through active service considered. — 3446, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer, knowlege of E.H.P., A.C., also D.C. Commencing salary £3 5s., or according to experience.—Apply to the LLANELLY & DISTRICT ELECTRIC LIGHTING & TRACTION CO., LTD., 15, Cowell Street, Llanelly. 3469

SILK Shades.—Manageress to take charge workroom. Must thoroughly understand high-class goods. Liberal salary.—Write in confidence, 6051, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SKILLED Fitters and Wiremen, for erecting electrical installations in London, Sheffield and Derby districts. Recognised rates and district allowances paid.—Write, giving particulars of experience, &c., to CONSTRUCTION DEPARTMENT, B.T.H. Co., Rugby. 3240

SMART Assistant Engineer in country supply station. Wages 50s. per week, plus 12½ %.—Applications, with copies of testimonials, to ENGINEER, Electricity Works, Ascot, Berks. 6304

STOKER wanted for Electricity Works near London. Good wages paid. — 3496, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant wanted with experience in A.C., H.T. and D.C. supply.—Reply, with copies of testimonials, stating age and wages required, also experience, to the SHEERNESS AND DISTRICT ELECTRIC POWER & TRACTION CO., LTD. 3368

SWITCHMAN wanted, accustomed to paralleling large E.H.T. 3-phase sets.—State age, experience and salary required, to 3487, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TELEPHONE Apparatus Draughtsman. Fully qualified man required by large firm in North London; must be well up in design of telephone and kindred apparatus. Splendid opportunity. —State age, salary required, and experience, to 3497, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, an experienced Engineer, for estimating and designing country house installations (electric, gas); knowledge of fittings design, and experience in showroom preferred.—State experience, age, and salary expected, 3411, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED at once, Shift Engineer for 1400-KW. power station. Experienced in E.H.T., A.C. and D.C. Must be sound Mechanical Engineer. Good permanent position for capable man.—3498, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by electrical manufacturing firm as Personal Assistant to Director, young man with electrical and mechanical training; one with several years' workshop experience preferred.—State fully, experience, age and salary expected, 6090, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED by English Electricity Supply Company operating in China a Power-house Superintending Engineer accustomed to running and maintenance of Belliss engines, water-tube boilers and direct current machinery; also a Mains Engineer to superintend overhead mains system, consumers' services and meters, &c. Passage paid by company. — Apply, giving age, experience and salary required, to MAY & HAWES, 36, Victoria Street, Westminster, S.W. 1. 3439

WANTED, competent Electrical Engineer to take charge of electrical plant in large engineering factory in the Midlands. —Write, giving fullest particulars of experience and qualifications, salary required, &c., to Box 985, Willings, 125, Strand, W.C. 2. 3424

WANTED, Electrician, good all-round hand; permanency.—3502, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

WANTED, Draughtsmen, several, at once, for telephone and electrical apparatus drawings; also Tool Draughtsmen. Good permanent position for competent men. No one resident more than 10 miles distant, or already on Government work, need apply.—Please state age, experience and salary required, to Box 156, Sells, Ltd., 168, Fleet Street, E.C. 4. 6225

WANTED, Engine Driver for electric power station; man with steam turbine experience essential. Wages (inclusive of all war bonuses to date), 63s. 6d., plus 12½%, per week of seven 8-hour shifts.—Apply GENERAL MANAGER, South Lancashire Tramways Company, Atherton, Lancs. 3445

WANTED, experienced Driver, accustomed to steam turbines and vertical engines. Lancashire coast town. Hours 56 per week.—Apply, stating experience, age, &c., to 3454, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, experienced Jig and Tool designers for large controlled electrical works in Midlands; must have good knowledge of press tools for small mechanical details, and positions are permanent for really capable men.—Apply, stating age, experience and wages required, to 3396, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, first-class Armature Winders for London repair shop. Best rates paid.—3366, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, first-class Electrician, used to power work, thoroughly conversant with motors.—MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 3501

WANTED for steel works and blast furnace plant in Monmouthshire, one Armature Winder accustomed to A.C. and D.C. repairs; also two Foremen Electricians to take 12 hours' shift, night shift and day shift, week about. Only men of experience need apply.—3428, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED (for Western County), Working Electrical Engineer used to country house installation; with presence and capabilities suitable for improved position later.—Apply, stating wages required, &c., to 3495, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Gentleman used to catalogue compilation and minor advertising work, by one of the leading firms in the electrical trade.—Write stating age, qualifications and experience in similar work, together with commencing salary required, to 3493, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED immediately, several first-class Armature Winders; must be used to heavy-class work.—Apply BURDETTE AND CO., LTD., 7, Pocock Street, Blackfriars, S.E. 3433

WANTED immediately, Wireman-Jointer. Trade union wages. —ELECTRICITY OFFICES, Manns Road, Edgware. 3499

WANTED, Improver in H.T.A.C.M.S., state age, wage, and experience. Experience in wiring necessary.—F. R. WINDSOR, Generating Station, Monmouth. 3488

WANTED, Power and Maintenance Engineer, to take control of small steam generating plant, motors, &c., heating, lighting, millwrighting, and general factory maintenance. Must have good technical experience, and be used to handling labour. —Write, stating experience, salary, &c., to 3349, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Toolroom Foreman for small shop, magneto works. Must have had considerable experience in the design and manufacture of tools for small interchangeable apparatus, and accustomed to handling labour economically.—Write, stating salary, experience, &c., to 3350, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WINDERS required for motor car lighter-starter dynamos. Only those who have had experience in this particular branch of winding need apply.—SIMMS MOTOR UNITS, LTD., Gresse Street, Rathbone Place, W. 1. 6271

WIREMAN and Wireman's Mate required, thoroughly used to screwed power and lighting installations. Wages 10½d. and 8d. respectively, plus war awards.—ELECTRIC SUPPLY CO., 480, High Road, Tottenham. 3494

WIREMAN (Good Jobbing); also Improver. Earl's Court district.—Write experience, YOUNG, 53, Rosenau Road, Battersea, S.W. 11. 6307

WIREMAN, good man, used to factory work.—RUSSELL, Loates Lane, Watford. 6224

WIREMAN required, used to all systems.—State wages and experience, STRATFORD-ON-AVON ELECTRICITY CO., LTD. 3441

WIREMAN wanted, good all-round, used screwed and slip, lighting, power, &c.—COLLEY, 51, Great Ormond Street, W.C. 1. 6273

YOUNG men required, with some electrical experience, to train as Assistants at electric vehicle battery depôt in London, and also as Assistant inspectors. Wages to commence £2 10s. per week. —Apply, stating age and experience, to 3416, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A BREWER'S Chief Electrical and Mechanical Engineer desires change.—6240, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER desires position as Works Foreman (engineering). Held position in press and core building shops for eight years in electrical firm in Midlands. Works foreman in manufacturing and repair shop, Liverpool district, three and a-half years. Age 44. Disengaged.—6107, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (25) requires responsible and progressive position. Good general electrical experience. Speciality wireless apparatus and plant. Capable organiser; accustomed to control of men and women.—6317, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER, 25 years' experience, been on Government work past three years, desires position of supervision or maintenance inspector.—6083, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (28), desires position with firm of contracting electrical engineers; eight years' contracting experience, good organiser, possesses initiative and business ability.—6319, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (29) desires post; late Assistant Electrical Engineer H.M. Factory; 11 years' experience power house, test room, experimental, speciality instruments and small apparatus. —6144, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Engineer, college diploma, practical training, 14 years' experience, electrical and mechanical, requires responsible post; contract work or maintenance preferred.—6301, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARC Lamp Fitter; preference for corporations; thirteen years' experience on all types of flames and open arcs.—6234, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AS Works Chief Electrician, or Assistant to Contractor. Thorough experience. Erection, upkeep, supervision, interviewing, knowledge estimating. Complete installations, factory, town and country house. Good references.—6282, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSEMBLY or Test Shop Assistant. Officer (21), 2½ years in charge wireless station, desires post with firm manufacturing wireless apparatus or electrical instruments. First-class certificate, radiotelegraphy. I.C.S. student; energetic, ambitious, trustworthy. Released one month after appointment. In or near London preferred.—6179, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Resident Engineer, young, desires change; some D.C. experience, and 4 years' E.H.T. and L.T. transformation and distribution; South Coast or S.E. counties preferred.—6116, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AUTOMATIC Telephones.—First-class instrument maker seeks position as Foreman of assembling department. Similar position held. Used to control of men, good organiser; 20 years in electrical trade. British and American experience.—6259, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CABLE Manufactures.—Advertiser seeks re-engagement; 26 years' experience, washing, mixing, callendering, forcing, longitudinal covering, braiding, stranding, vulcanising, &c.; control of labour; home or abroad.—6128, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CAPABLE Electrical Engineer, 14 years' practical and technical experience, seeks position where ability is appreciated.—6067, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer, desires permanent post. 16 years' sound experience; A.C. and D.C., &c.—MR. B., c/o Baldwin, 47, Cliffe Street, Keighley, Yorkshire. 6088

CHARGE Engineer, good mechanical experience, A.C. and D.C., &c., requires post.—6213, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CLERK, ten years' experience Electric Supply work, accounts, wages, allocations, stores, &c., desires change.—6093, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMMERCIAL Electrical Engineer wishes to represent electrical firms, North of England. Expenses and commission.—6279, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMMERCIAL Engineer, at present with leading Scotch firm, wishes responsible position. Organising ability combined with extensive practical and commercial experience in the application of electricity to industrial problems. Technical training; good estimator, correspondent and interviewer. Interview Glasgow. —6258, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONSULTING Engineers open for further work.—6237, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CONTRACTORS' Electrical Engineer (31), desires appointment, Home or Abroad. 10 years' supervision experience in L.T. and E.H.T. cable laying and overhead transmission lines, colliery, town lighting, &c. Present, engineer manager, electric supply company.—6089, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

DRAUGHTSMAN, Electrical (22).—6248, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRIC Light, power, telephones, installations, or repairs. Used modern factory equipment, take charge or otherwise. —6294, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer (aged 43), having had over 20 years' experience in the manufacture, lay-out, erection and maintenance of power plants, accustomed to control large number of men, is now open for engagement.—6308, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer desires appointment; 12 years' experience in oil and gas-driven plant, power and lighting installations and maintenance; commercial experience; late Admiralty overseer; London district or Southern counties preferred.—6302, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, experienced (46), seeks situation. Country charge of plant, steam, gas, oil, Diesel engines. Late of a duke's large up-to-date plant. Repairs, alterations, improvements.—6192, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL and Mechanical Engineer, H.T., three-phase, D.C. and turbine experience. Held responsible position in large power house. At present engaged at munition works, will shortly be at liberty to take another post.—6212, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Contractor's Foreman desires change; over 20 years' practical experience factory and private installations and maintenance A.C. and D.C.; good references.—6161, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer desires appointment as Manager. Experienced in layout of large power and lighting installations and maintenance. Workshop and office routine; technical; able to control staff.—6124, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer desires responsible appointment in connection with electric lighting and power distribution, layout of installation, charge of power house, inspection of plant, &c., control of staff; economical working.—6261, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, disengaged, requires situation; 18 years' experience in all branches, technical and commercial training. —6127, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, fully trained and experienced, seeks position in commercial dept. of electrical firm or electrical dept. of mechanical engineering firm. Willing to go abroad.—6252, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, shortly be demobilised, 15 years' chief electrical engineer to large town. Previous consulting and contracting engineer. Good experience of power company's supply systems, Government departments.—6251, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, university graduate, M.I.E.E., 23 years' wide and varied practical and commercial experience generation, distribution, industrial application and use electricity, desires responsible position with progressive manufacturer, contractor or consultant.—6233, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (30), four years' college, three years' apprenticeship, power house and test, drawing office, switchgear design. Prefer technical assistant to large undertaking or manager-designer of general electrical manufacturing shop.—6255, ELECTRICAL REVIEW 4, Ludgate Hill, London.

ELECTRICAL Engineer (31) desires engagement; 10 years' experience, including production, test and technical representative.—6246, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (34) desires appointment; 15 years' wide practical and technical experience contracting, commercial, supervision transmission lines and cables, control of labour. £350 per annum.—6260, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (45), 20 years' practical experience, steam, petrol, oil and suction gas power plants, accumulators, mains, installations, telephones, estimating and interviewing, at present charge five contracts (country), all obtained on own initiative, desires appointment where thorough business ability and zeal is appreciated.—6321, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Mechanical Engineer (35), desires staff position College, shops, central station (mains and generation), contracting, manufacturing, and commercial experience. Sound theory. Now managing electrical department under Admiralty. Experimental work if required. Midlands preferred. £350.—6065, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN, maintenance, lighting and power; used to busy machine plant; good all-round hand.—6157, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SITUATIONS WANTED.—*Continued.*

ELECTRICIAN, well up in motors, lighting, switchboards and machinery; 10 years' experience. — 6080, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN (35), desires berth. Thoroughly experienced, dynamos, motors, lighting, accumulators, conversant with steam engines. Charge of plant preferred.—BROWN, 601, Romford Road, Forest Gate, E. 7. 6298

ELECTRICIAN-Wireman, light, bells, 'phone, new, jobbing.—E., 12, Colville Road, W. 11. 6306

ELECTRICIAN - Wireman seeks situation, factory or estate. D.C. motors, general maintenance. — A., 28, Cavendish Dwellings, Allen Street, E.C. 1. 6322

ENGINEER, A.M.I.E.E., age 36, practical and commercial electrical experience, desires position as Representative, speaks fairly good French, would go abroad; at present Assistant Electrical Engineer at Admiralty Dockyard. — 6079, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ENGINEER, electrical and mechanical, practical and technical experience, good organiser and controller of labour, possesses initiative, tact and business ability.—35, de Crespigny Park, S.E. 5. 6172

ENGINEER, experienced, working, 22 years' experience in charge of Large Works, doing all own erecting, own repairs, both electrical and mechanical, thoroughly reliable, excellent testimonials, disengaged. — POWELL, 70, Standen Road, Southfields, London, S.W. 6103

ENGINEER, with 18 years' experience, requires position as Representative, Lancashire and Yorkshire district preferred, as advertiser is well known there in connection with Electrical Apparatus.—6276, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Electrician (34), married, discharged soldier, desires re-engagement on private estate; thorough knowledge of gas, oil engines, electrical plants, farm and dairy machinery.—A. REED, 40, Sherborne Road, Yeovil, Somerset. 6075

FOREMAN Assembler, with long and varied experience in electrical industry, seeks situation with large firm of manufacturing electricians. Expert on Switchboard and Controller work. Sound references.—6280, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN (Instrument Maker), nine years' experience as such, Age 36, active, able to get production.—6131, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN Overhead Linesman, with Indian experience, needs situation; used to heavy mains and pole erection.—HUNT, 56, Cephas Street, London, E. 1. 6293

INDIA.—Mechanical and Electrical Engineer, who speaks Hindustani fluently, requires responsible post. Holds first class B.O.T. Experience includes erecting and running plant, A.C. and D.C., D.O., refrigerating.—6236, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LABOURER disengaged (N.S.V.).—J. F., 32, Claremont Square, Islington, N. 1. 6289

MECHANICAL and Electrical Engineer, workshop and drawing office training, 16 years' experience in constructional and maintenance of modern power station, desires change, similar work. —6151, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OFFICER, with good pre-war experience in electrical engineering technical, workshop, drawing office, and power house construction, wishes to correspond with principals, with view to position; small progressive firms preferred.—6066, ELECTRICAL REVIEW, 4, Ludgate Hill, London,

R.A.F. Officer (25), with good pre-war experience in electrical engineering, technical, drawing office, testing mains, and power station, desires to correspond with principals with a view to appointment. Interview can be arranged at any time.—6285, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

RELIABLE Electrical Engineer (33), technical, 18 years' practical trade experience, charge and resident engineer of power plants, oil and gas, town supply, construction, contracting, genuine man, seeks position of worth.—6296, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TELEPHONE Installer desirs change; 10 years' experience, C.B. systems. Used to supervising men.—6267, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

THREE Outside Erectors seek erection of plants on contract or otherwise, on gas, steam and mining; wide experience both home and abroad.—H. A., 238, Peel Green Road, Patricroft, near Manchester. 6183

TO Managers of up-to-date Electric Supply Undertakings.—Capable Staff Engineer wants post. £300.—6283, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TO Managing Directors.—Advertiser, a thorough Commercial Electrical Engineer (technical), with enormous City experience, dealing exclusively with War Office and Admiralty contracts, is open to engagement. Highest credentials, love of work and full of energy, gentlemanly in appearance and manners, fully conversant with business methods A to Z and knows precisely how to interview prospective clients. Army record, commissioned rank; discharged; limbs and brains left intact. Who will utilise to the best advantage?—6266, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

WANTED, position by an Electrical and Mechanical Engineer; experience abroad; just released from commissioned service.—6241, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, progressive responsible position, sales, buying, &c. Wide experience. Last situation 14 years. Technical and practical experience. Highest refs.—6054, ELECTRICAL REVIEW, 4, Ludgate Hill, London,

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Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

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ELECTRICAL Engineer, (33), A.M.I.C.E., A.M.I.E.E., with varied experience, including instrument and research work, desires responsible post. Would invest £1000 in sound concern.—6117, ELECTRICAL REVIEW, Hill, 4, Ludgate London.

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ADVERTISER, 20 years' experience, with live connection amongst best-class electrical houses, wishes to take up Agencies for London and district for French and English Electrical Fittings.—Apply DAVIS, 11, Sun Street, E.C. 2. 3479

ADVERTISER, 22 years' experience, wishes to take up Agencies for Yorkshire, Lancashire and North of England, for Accessories, wires, cables, motors, switchgear, fittings, carbons, conduits, bells, heating and cooking, miners' electric lamps, and engineering supplies.—Particulars, 6189, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES wanted for all classes of Electrical Goods. First-class connections.—3486, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

AGENCIES.—*Continued.*

AGENCY for Tyne, Tees and Wear area, for post-war activities. An Electrical Engineer, of 20 years' standing, is prepared to act as Representative of single firm of manufacturers, or would work agencies for C.M.A. firm, generators, motors, transformers, &c., for reputed manufacturers of these articles.—6263, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENTS required for all parts of the country to handle goods of a firm manufacturing Resistance Apparatus.—Apply in first case, stating terms and ground covered, to 6191, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENTS wanted in the following towns and districts for a well-known firm of Lift and Crane Makers: Aberdeen, Bristol, Plymouth, Cardiff, Hanley, Nottingham, Sheffield, Leeds, Harrogate, Newcastle, Hull, Belfast, Brighton, Portsmouth, Grimsby, Bournemouth, Manchester, Lowestoft, Folkestone, Weymouth, Torquay, Ilfracombe, Basingstoke, Winchester, Margate, Colchester, Ipswich, Bath, Hastings, Derby, Eastbourne, Tunbridge Wells, Reading, Southampton, Bradford, Scarborough; also in Belgium and France.—6274, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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CUNNINGHAM, Ltd.—Will manufacturers desiring active agents please communicate.—171, Edgware Road, London. 6205

ELECTRICAL and Mechanical Engineer, with sound business connections, is about to open City office, and is desirous of representing one or two reliable firms in London.—6262, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Firm, with extensive showrooms in West End of London are open for Agencies. Motors, Dynamos and Tools.—Apply WALLACE & Co., 53, 56 and 58, High Street, W.C. 6074

ELECTRICAL Goods (Export).—Electrical Engineer (French), 10 years with important company in Paris, wishes to represent first-class English house desirous of extending in France.—L. LODI, 17, Rue Peligot, Enghien, near Paris. 6203

ELECTRICAL Supplies for ships and factories. Electrical firm with offices and stores in City, is desirous of representing manufacturers for Liverpool and district.—6064, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEERING Manufacturers, mechanical, electrical and chemical plant, desiring Representation in Scotland, are requested to communicate with a University graduate in engineering, A.M.I.Mech.E., A.M.I.E.E., who is opening an office in Glasgow.—Address, "GRADUATE," Wm. Porteous & Co., Advertising Agents, Glasgow. 6277

ENGINEERS in Liverpool are desirous of representing manufacturers of electrical accessories and engineers' supplies. Offices and storage accommodation in city. Good connection with shipping and factories in district.—6318, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FIRM of merchants and agents in Glasgow, with valuable connection throughout Scotland, are open to consider agencies for high grade electrical material.—6132, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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GLASGOW Electrical Firm is desirous of representing manufacturers of Electrical Specialities, Labour-saving Tools, &c. Excellent showroom, storage accommodation and connection.—6200, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LOCAL Agents wanted in every town to represent the Cleveland Metal Co., Ltd., Bridge Works, Stockton-on-Tees, makers of White's Patent Controller Fingers, and Controller Fingers and Segments for all types of Controllers. Commission basis only.—6231, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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MANCHESTER Electrical Firm, with good show and store rooms, require Agencies for Motors, Dynamos, Switchgear and Conduit. First-class connections.—3485, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SOLE Agents required in large towns for patent apparatus converting any make of hand lift or crane to power by utilising existing gearing without alteration. Many already in use. Firms applying must be able to supply and fix the necessary electrical equipment and erect the patent Deplaro, which will be supplied on satisfactory terms.—PICKERING HOIST Co., Parliament Mansions, Victoria Street, London, S.W. 1. 3405

AGENCIES.—*Continued.*

TO Electrical Manufacturers.—Representative (Electrical Engineer), good connection in Lancashire and Yorkshire, requires speciality lines or agencies, lamps, flash lamps, A.C. or D.C. equipment, accessories. New ground worked. Expenses and commission.—6256, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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FOR SALE.

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PORTABLE Screw-driven Column Type Slotting Machine, with circular motion, to column about 4′ 6″ stroke.

Motor-driven Face-Milling Machine (by Hetherington and Co.), with facing head, 18″ diameter.

Geared-driven Duplex Screwing Machine (by Dron and Lawson), with dies up to 2½″ diameter, Whitworth thread.

Portable Electric Radial-Arm Drilling Machine (by Kendal and Gent), 6′ arm, 2¼″ spindle.

No. 2 size powerful Motor-driven Portable Facing Machine for roller paths of large gun turrets, swing bridges, &c.

10′ Faceplate Triple-geared Boring and Facing Lathe (by H. Broadbent), with self-acting swivel slide rests.

6′-swing Triple-Geared Boring and Facing Lathe (by H. Broadbent), with internally-geared faceplate, 4′ 6″ diameter.

Automatic Horizontal Drop-Valve Engine (by Robey and Co.), with cyl. 20″ diameter, 2′ 6″ stroke.

Horizontal Corliss Engine (by Hick, Hargreaves), with cyl. 18″ diameter, by 36″ stroke.

Duplex Horizontal Boring Machine (by Butler), two upright standards, 7′ high, carrying boring saddle with 3½″ spindles.

CATALOGUE of Stock MACHINERY. 2-3000 LOTS. Free on Application. Inspection invited.

THOS. W. WARD, LTD., ALBION WORKS,
Tel.: "Forward, Sheffield." SHEFFIELD.

R. H. LONGBOTHAM & CO., LTD., WAKEFIELD,
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Tel.: { 44 Wakefield. / 867 Newcastle. } Telegrams: "Engineer, Wakefield."

FOR SALE.

ONE Parsons Steam Turbo, 1500 KW., 2-phase, 2000 volts, 50 periods. Complete with condensing plant.

One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.

One 500-KW. triple-expansion Set, engine by Browett and Lindley, H.P. cyl. 17½″, I.P. 25″, L.P. 35″ × 14″ stroke. Single-phase Alternator, by British Westinghouse Co., 2100 volts, complete with exciter, &c.

One 225-KW. Generating Set, engine tandem comp. type, 300 H.P., with Corliss Valve Gear, &c., B.T.H. Generator, 500 volts, compound wound.

One Surface Condenser, by J. & H. McLaren, capacity 3000 cls. per hour, with circulating pump.

Two Exciters, 180 volts, 80/100 amps., 200 R.P.M. 5277

ELECTRICAL PLANT FOR SALE.

ONE 300-KW., 220/250-volt Generating Set, comprising "Howden" enclosed compound engine, coupled to compound interpole Generator.

One 500-KW., 220/250-volt Generating Set, comprising "Belliss" enclosed compound engine coupled to compound-wound Generator, and complete with condensing plant.

One 450-KW., 500-volt Set, as above, with or without condensing plant.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw,
Glasgow. 2429

NEW MOTORS AND GEAR.

1, 2, 5, 8, 10, 15, 20, 25, 30 H.P., A.C., 2 and 3-phase; also D.C., 220 v., and 440 v., complete with Starting and Switch Gear. Lighting and Power Home Office Distribution Fuse Boards. Cable 1/18 to 37/16 C.M.A. and non-Association, 600 megh. Immediate delivery. Guaranteed 18 months.

"ROBUST MACHINERY," 62, Bradford Street, Walsall. 3314

(Continued on next page.)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

D.C. MOTORS.

H.P.	Volts.	R.P.M.	Windings.	Makers.	Type.
30	400/440	850	Shunt intple.	Royce Bros.	Encl's'd, v'ntilat'd.
27	460/480	950	" "	Brush Elec.	" "
20	440/460	750	" "	Bruce Peebles	" "
20	440/460	1250	" "	E.C.C.	Tot. en., pipe vent.
15	230	800	" "	Royce Bros.	Encl's'd, v'ntilat'd.
13	400/420	1000	Shunt wo'nd.	Mather&Platt.	Totally enclosed.
12	200/220	950	" "	Cutting Bros.	Encl's'd, v'ntilat'd.
10	420	1000	" "	Electromotors.	" "
10	400/440	750	Shunt intple.	"	Totally enclosed.
9½	400/460	750	" "	E.C.C.	" "
8	230	480	" "	Royce Bros.	Encl's'd, v'ntilat'd.
8	440	950	Shunt wo'nd.	Gen. Elec. Co.	Tot. en., reversing.
7½	440	880	" "	Siemens Bros.	Encl's'd, v'ntilat'd.
7½	230	880	" "	" "	Totally enclosed.
5	230	880	" "	" "	Encl's'd, v'ntilat'd.
5	440/460	1200	" "	Cutting Bros.	" "
4	400	1150/1835 variable.	" "	Gen. Elec. Co.	" "

A.C. MOTORS.

H.P.	Volts.	R.P.M.	Periods.	Phase.	Makers.	Type.
30	400	750	50	Three.	Clayton Motors.	Encl's'd v'ntilat'd.
12	420	960	50	"	Gen. Elec. Co.	" "
10	440	950	50	"	Brook & Co.	Tot. en., pipe vent.
5	420	1450	50	"	Wright & Wood.	Encl's'd v'ntilat'd.
3	420	1450	50	"	" "	" "

GENERATORS.

17 KW., 230 volts, 1200 R.P.M., shunt wound, Holmes & Co., makers, enclosed, ventilated type.
300 watt, 160 volts, 1250 R.P.M., shunt wound.

YARNALL & CO.,
Cornwall Street Ironworks,
Openshaw, Manchester. 3259

MOTOR GENERATORS.

TWO Complete Sets, comprising 16-H.P., 400/480-volt, D.C. Motor, coupled on cast-iron bedplate to 60/80-volt, 1100-revs., 120-amp. Dynamo, by the General Electric Co., Ltd. (one set never been used), complete with polished slate control panel, with circuit breakers, switches, fuses, regulators, starters, douple-pole change-over switch, &c., &c. (made to Post-Office specification); also Motor Generator, by Westinghouse, comprising 3-H.P., 220-volt, 1300 revs., protected-type Motor, coupled to 50/70-volt, 25-amp. Dynamo, with 30 7-plate Chloride batteries,complete wit h stands and control gear; Motor Generator, by the Lancashire Dynamo & Motor Co.; 200/240-volt D.C. Motor, coupled to 80-amp., 70-volt Dynamo.

Full particulars from—

C. J. FERGUSON & SONS,
54, Chiswell Street, E.C. 1. 3387

ELECTRIC PLANT.

MAGNIFICENT 500-H.P. Horizontal Tandem Gas Engine, together with 350-KW. Alternator, by G.E.C., 230 volts, three-phase. Price £2,500. Set will be sold separately if desired.

One 300-KW. Alternator, by the Westinghouse Co., 2400 volts. Price £600.

One 250-KW. Belt or Rope-driven Multipolar Generator, by B.T.H. Co., 500 volts, D.C., compound wound; a very fine machine. Price £575.

One 100-H.P. Belt or Rope-driven Multipolar Generator or Motor, by Parker, 230 volts, D.C., compound-wound. Price £250.

Six 25-H.P. Traction Motors, series wound, 500 volts, by G.E.C. Price £75 each.

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One 6-H.P. Series-wound Motor, 230 volts. Price £25.

JOHN F. WAKE, Engineer, Darlington. 3145

EDINBURGH CORPORATION.

Electricity Supply Department.

FOR SALE, two sets of tandem compound three-crank Belliss Engines, 160 lbs. steam pressure, coupled to Siemens 6-pole, 390-KW., shunt-wound dynamos, 460/510 volts.

One III. Willans compound three-crank Engine, 160 lbs. pressure, coupled to Siemens 2-pole, 225-KW., shunt-wound dynamo, 460/510 volts.

This plant can be seen by appointment.

Tenders marked "Sale of Plant" to be sent to the TOWN CLERK, City Chambers, Edinburgh, not later than DECEMBER 16th.

F. A. NEWINGTON,
Engineer. 3475

MOTORS AND DYNAMOS.

MOTORS and Dynamos, new and second-hand, large number for sale, all guaranteed.

THE VICTORIA ELECTRIC PLANT CO.,
Spenser Street, Westminster. 3330

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

TURBOS AND GENERATING SETS.

1000-KW. Turbo-Generator, A.E.G., 500 volts, 50-period, 3-phase, complete with two switch panels, surface condenser, electrically-driven air and circulating pumps, together with the piping and a quantity of new spare parts. The whole practically equal to new and ready for immediate despatch at Liverpool.

500-KW. Parsons Steam Turbo, 460/500 volts, D.C., in perfect condition, and complete with condensing plant.

Also 300, 256, 200, 185, 160, 120 and 48-KW. Belliss Generating Sets, 460/500 volts and 220 volts, D.C.

One 200-KW. Allen-Holmes-Clayton, 500-volt, 50-period, 3-phase.

MOTORS.

One Crompton, 150 H.P., 25 periods, 3-phase, slip-ring.

One Westinghouse, 14 H.P., 350/400 volts, 50 periods, 3-phase, slip-ring, 940 revs.

One Phœnix, 290 H.P., 460 volts, D.C., 400 revs., three bearings.

All the above are ready for immediate despatch.

Apply FRANK GILMAN, Lightwoods Hill, Birmingham.

Telegrams: "Gilman, Lightwoods, Birmingham." Telephone: 1081 Edgbaston. 2128

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FOR Sale, the following Gas Electric Plant, which is being superseded for a more extensive supply:—

One practically new Mond Gas Producer, 1200 B.H.P. continuously, for supplying Mond gas for driving gas engines, and supplying gas for furnaces, complete with Coal Handling Plant. Available now.

Three 105-KW. Hindley 5-cylinder vertical Gas Engines, direct coupled to 500-volt D.C. Generator. Available now.

Two 180-KW. do. do., in process of manufacture.

One 35-KW. do. do., just delivered.

Two 205-B.H.P., 500-volt Motors, 290 revs., suitable for direct coupling to Compressors.

One compound-wound Generator, 310 amps., 240 volts, 540 R.P.M.

One compound-wound Generator, 128 amps., 250 volts, 900 R.P.M.

For further information apply to MESSRS. TELFORD, GRIER AND MACKAY, LTD., 16, Carrick Street, Glasgow. 3190

GENERATING SETS FOR SALE.

TWO 500-KW. Belliss & Morcom-Bruce Peebles, 500 volts, D.C.
One 150-KW. Belliss & Morcom-Bruce Peebles, 500 volts, D.C.
One 500-KW. Browett, Lindley-Bruce Peebles, 500 volts, D.C.
One 150-KW. Belliss & Morcom-Silvertown, 220 volts, D.C.
Two 178-KW. Scott & Mountain's, 220 volts, D.C.

For particulars, apply,

ROBERT WALKER,
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Glasgow. 3503

FOR IMMEDIATE SALE.

THREE A.C. Generating Sets, comprising compound double-acting high-speed Engines ("Sentinel"), 220 B.H.P. each, coupled direct to 150-KW. Generators (Westinghouse), 440 volts, 25 periods, three-phase.

Two D.C. Generating Sets; compound, double-acting high-speed Engines ("Sentinel"), 45 B.H.P., coupled direct to 30-KW. Generators (Westinghouse), volts 250.

Four Durr Water-tube Boilers, 1614 sq. ft. H.S. each; working Press 120 lbs. per sq. in.

One Main Switchboard and Accessories, &c.

All in good order.

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FOR Sale at reasonable prices, from stock, Lampholders, Switches, Cables, Delcoblast Lamp Obscurer, &c., &c.

DAVIS, 11, Sun Street, E.C. 2. 2780

(*Continued on next page.*)

FOR SALE.—*Continued.*

MACHINERY FOR SALE.

250-KW. Belliss-E.C.C. Set, 460 v., D.C.
225-KW. Willans-Siemens Set, 410 v., D.C.
75-KW. E.C.C. Machine, 110 v., D.C.
Electric Sinking Pump, 20 H.P., 220 v., D.C.
30-H.P. Laurence-Scott Motor, series wound, 460 v., D.C.
20-KW. Machine, 205 v., D.C.
Motor-Generator Set, 230 v., 30 amps., to 55/80 v., D.C.
31-H.P. Siemens S.C. Motor, 500 v., 3-phase, 50 cycles, 1,450 R.P.M.
600-H.P. E.C.C. Motor, 2,000 v., 2-phase, 50-period, 730 revs.
450-K.V.A. Generator, 110 v., single-phase, 25 cycles, 730 R.P.M.
D.C. and A.C. Starters.
Ammeters, Cable.

BURY ELECTRICAL PLANT CO., LTD.,
Monitor Works,
Bury.
'Grams: "Electric Bury." 'Phone: 676 Bury. 3394

MOTORS FOR SALE OR HIRE.

One	12	H.P.,	200 v., D.C.	Two	10	H.P.,	110 v., D.C.
„	10	„	200 „	One	11	„	110 „
„	3	„	240 „	„	2	„	200 v., 50 per., A.C
Two	5	„	480 „	„	3	„	200 „ „
One	3	„	480 „	„	3	„	400 „ „
„	8	„	440 „	„	8	„	400 „ „
„	6	„	400 „	„	9	„	400 „ „
„	15	„	480 „	„	10	„	200 „ „

All machines are in good condition and complete with starters and pulleys.

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MOTORS FOR SALE.

Two 70-H.P., 220 D.C., Laurence, Scott, 620 R.P.M.
One 50-H.P., „ „ „ „ 620 „
One 30-H.P., „ „ „ „ 620 „
One 25-H.P., „ „ „ „ 700 „
One 20-H.P., „ „ B.E.P. 800 „

With pulleys and rails, and equal to new.

R. WALKER,
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Glasgow. 3451

MACHINERY FOR SALE.

ONE Generating Set Comprising:—
"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.
Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

COUNTY BOROUGH OF HALIFAX.

Halifax Corporation Electricity Department.

FOR Sale, two Weir Boiler Feed Pumps, capable of delivering 6,000 gallons of water per hour. Also a quantity of 7" and 10" steel Steam Pipes.
For particulars apply—

MR. W. M. ROGERSON, M.I.E.E.,
Borough Electrical Engineer,
Halifax. 3333

ELECTRIC DYNAMOS AND MOTORS.

MACHINES always available for Sale or hire.
ARMATURES and FIELD COILS
rewound or repaired without delay.

'Phone: 5773 Holborn. MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 8485

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TORCHES with Bulbs, Flash Lamp Cases, at exceptional low prices.

W. F. CO., LTD.,
23/27, Commercial Street, London, E. 1. 3329

FOR SALE.—*Continued.*

CABLE FOR SALE.

550 YARDS ·025 square inch E.H.T. 3-core, paper lead covered, steel tape armoured Cable, 5000 volts to E.S.C.
10,000 yards 7/20's high-tension, 3-core, paper lead covered, steel tape armoured Cable, 3300 volts to E.S.C.
10,000 yards 7/16's low-tension, single, paper lead covered, steel tape armoured Cable to E.S.C.
Above Cable manufactured for Government; not now required owing to cessation of hostilities.

3506, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

OERLIKON TURBO-GENERATOR.

FOR SALE, one 1050-KW. L.P. Oerlikon Turbo-Generator, 1500 R.P.M., 6000-volt, 3-phase, 50 periods. Turbine designed for use with exhaust steam at atmospheric pressure. Generator, asynchronous type. Contraflo Surface Condenser, 3350 sq. ft., by Richardsons, Westgarth & Co., with Edwards air pump and circulating pump. The plant is in first-class running order, and can be seen at work at any time by appointment.
For full particulars apply to the CENTRAL ELECTRIC SUPPLY CO., LTD., Grove Road, St. John's Wood, N.W. 3477

FOR SALE.

250-KW. Belliss-E.C.C. Set, comprising Belliss high-speed, 3-crank, compound engine, direct-coupled to E.C.C. generator, 440/460 volts, D.C., 560 amps., 380 R.P.M., with Körting ejector compound, also spare armature. Can be seen running by appointment.—RUBY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 2746

CUNNINGHAM'S REGISTER.

A REGISTER OF MOTORS, &c., for sale and wanted. No charge is made.
Send particulars of YOUR NEEDS (as a buyer or seller).

171, Edgware Road,
'Phone: Padd. 5173. London, W. 2.

CUNNINGHAM, LIMITED.

SMALL Motors and up to 300 H.P. rewound and repaired.

Estimates free. 171, Edgware Road,
'Phone: "5173 Padd." London, W. 2.

BLACK TAPE.

5 CWT. each ½" and 1" for immediate disposal at 2s. 4d. per lb.

3461, ELECTRICAL REVIEW,
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CARBON LAMPS.

1650 CARBON LAMPS, 200 v., 16 C.P., guaranteed sound, £90 lot, cash.
Also 600 120 v., 16 C.P., £28 the lot.

THE BAXTER MANUFACTURING CO.,
23, King Street, Manchester. 6238

FLEXIBLE.

FOR Sale, 130 gross 14/36s S.V. Workshop Flexible.
96 gross 14/36s S.V. Cotton Flexible.
At 24s. per gross yards strictly net cash.
Free on rail. Packing at cost.

3444, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

MOTORS FOR SALE OR HIRE.

MOTORS ready for immediate delivery: 15 H.P., 220 v., 900 R.P.M.; 10-H.P. Wright & Wood, 220 v., 900 R.P.M.; 9-H.P. Crompton, 440 v., 1050 R.P.M.; 8-H.P. Woolnough, 220 v., 1100 R.P.M.; 7-H.P. Crompton, 440 v., 900 R.P.M.; 5-H.P., 220 v., 1000 R.P.M.; 5-H.P. B.T.H., 200 v., 1500 R.P.M.; and many smaller. Also three 2-pole Generators and 14 A.C. Motors.—E. P. ALLAM & CO., 107/109, Gray's Inn Road, W.C. 1. Holborn 1280. "Epaltrical, London." 3166

SPECIAL MOTOR AND GEAR.

40-H.P., D.C., 440/500 v., back gear, silent pinion; complete with starting panel, D.C. starter, switch fuses and meter.
30-H.P. Interpole Machine, D.C., 440 v., complete with D.A. starter and switch. Immediate delivery guaranteed.

"ROBUST MACHINERY,"
62, Bradford Street, Walsall. 3313

(*Continued on next page.*)

FOR SALE.—*Continued.*

Cheap prepaid Advertisements relating to second-hand goods and specified Articles are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).

TRADE RATES ON APPLICATION.

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CARBON Lamps, large stock, 10 to 300 volts, Bayonet Screw and Concentric Caps, various candle powers. State requirements.—HUDDLESTON, 72, Finsbury Pavement, London, E.C. 2. 6184

D.C. MOTOR-Generator, 220 volts, ½ H.P. to 25 volts 15 amps. Good condition and running order. Price £15.—PARSONS, King Edward Street, Hull. 3423

D.C. MOTOR-Generators, 400/460 v. to 70 v., 80 a.; ditto, 460 v. to 70 v.. 70 a.; ditto, 230 v. to 50 v., 50 a.; ditto, 230 v. to 70 v., 80 a. 230-v. D.C. Motors, 1½ H.P., £16 10s.; ¾ H.P., £12 10s.; ½ H.P., £9. 1 H.P., 110 v., £12 10s.; ½-H.P. ditto, £8 10s. Dynamo, 100 v., 100 a., £40. ½-H.P., 200 v., 100-cycle S.P. Motor, £8 15s. 50-v., 12-a. Generator, £12 10s.—"ELECTRICAL," 5, Osborne Terrace, Gosforth, Newcastle-on-Tyne. 6313

D.C. Motors 110 v., 1/25 H.P.; 230 v., ½/40 H.P.; 460 v., ½/150 H.P., D.C. Starters, to 150 H.P., good delivery, shunt regulators; Switchboards, Voltmeters, Ammeters, list. — 6314, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DIRECT-Current Motors for sale, 150, 180, 220 and 500-H.P. All modern slow speed machines.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw Glasgow. 3380

DYNAMOS, 200/250 v., 15, 60, 100, 450 a.; Dynamos, 110 v., 8, 10, 18, 30, 40, 50, 60, 70, 80, 90, 100, 125, 400, 520 a.; Dynamos 135 v., 30, 40, 60, 80, 200 a.; several 60/80 v., 60/100 a.—6315, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, 3000, 1500, 1000 and 750 amperes at 6 volts; also smaller sizes. Apply for lists.—CANNING & Co., Electro-Platers Engineers, Birmingham. 7769

ELECTRIC Vehicles.—Five three-wheel Vans; want overhauling. Cheap to clear.—J. HYAMS, 11, Glengall Terrace, Old Kent Road. 6265

EVERSHED'S Ohmmeter and Generator, 200 volts; very little used, in perfect condition. £12.—6316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, a solid brass three-branch Electrolier; fancy design.—6105, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Browett-Lindley 110-KW. Generating Set, 460/500 volt D.C. In first-class order.—SHEERNESS AND DISTRICT ELECTRIC POWER AND TRACTION CO., LTD., Sheerness East, Kent. 3420

FOR Sale, complete power installation, comprising:—Two 400-KW., 500-volt, 50-period, 3-phase Turbo-Alternators, with Exciters, Switchboard, Condensing Plant, motor-driven Pumps, and high-pressure Lancashire Boilers, &c., Plant can be seen under steam by appointment.—3471, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Electric Light Plant, Laurence, Scott Dynamo, 55 amp., 100 v., 860 R.P.M., with slides, condition as new. Slate switchboard with meters, switches and fuses. 8-H.P. Steam Engine, belting, pulleys, &c. Can be viewed perfect running order (Midland Counties).—6056, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Electric Lighting Plant, Siemens dynamo, 31 amperes, 100/150 volts, pulley, rails, charging switchboard, 58 E.P.S. cells, 180 ampere-hours. Splendid condition. Inspection invited.—3432, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Laurence, Scott Generator, 27 KW., 120 volts, complete with accessories; also one 35-H.P. Motor, 600/1200 R.P.M., 120 volts, Electromotors, Ltd.; one 25-H.P. Motor, 650/1200 R.P.M., 120 volts, Electromotors, Ltd.; one 7-H.P. Motor, 600/900 R.P.M., 120 volts, Electromotors, Ltd.; one 3-H.P. Holmes Motor, 120 volts, 790 R.P.M.; one Plating Dynamo, 6 volts, 100 amps. All in good working order; can be seen running.—6227, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Motor-Generator by the G.E.C., 500 volts, 225 amps., with two series-wound boosters, 110 volts, 400 amps. 650 R.P.M.—WILLIAMS & SONS, 37, Queen Victoria St, London. 3482

FOR Sale, Motor-Generator Set, Century Motor, 200/400 volts, 50 periods, single-phase, coupled to Laurence, Scott Generator, 226 amps., 120 volts, on cast-iron bedplate, complete with accessories. In splendid condition; can be seen running. — 6228, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, new Diesel Engine, direct coupled to 375-KW. 440-volt, D.C. generator, and complete with all fittings and spares.—3472, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, Plungers: 48 Midget, 5-amp., Home Office pattern. Sockets: 36 2-pin Midget complete; 50 2-pin Midget complete; 12 Tucker Midget, with lids; 46 Tucker flush Midget, complete; 36 Tucker Midget, sunk sockets, plungers complete; 36 Midget switch sockets complete; 26 Midget switch sockets, complete. Adaptors: 20 2-way Midget plug.—TAMPLIN & MAKOVSKI, LTD., Bell Street, Reigate. 3266

FOR SALE.—*Continued.*

FOR Sale, two Lancashire Boilers, 30′ × 8′ 6″ insured at 160 lbs., complete with Economisers and Superheaters; three 300-H.P., Alley and MacLellan Engines and Generators, 440 volts; one 200-H.P. ditto; one 90-H.P. ditto, Switchboard to suit same, all in splendid order. Will dismantle and put on trucks.—6290, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, two Vertical Self-acting Milling Machines, by Hulse; 3½" dia. spindle, with revolving table. Delivery from stock.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 3480

FOR Sale, two 200-KW. Belliss-Siemens Steam-Alternators.—For particulars apply to the MANAGER, Electricity Works, Mill Street, Ayr. 3331

FOR Sale, Westinghouse protected type Dynamo, 50/70 volts, 25 amp., 1,300 revs., complete with regulator, ammeter, voltmeter, and 30 7-plate Chloride batteries with glass boxes and stands (cells separately, if necessary).—C. J. FERGUSON & SONS 54, Chiswell Street, E.C. 1. 3388

FOR Sale, 10-ton Electric "Goliath" Drane, 36 ft. span, also 5-ton, three-motor Overhead Travelling Crane, 38½ ft. span, with 220-volt, D.C. Motors.—THE PHŒNIX ELECTRICAL Co., 32/36, Broomielaw, Glasgow. 3379

FOR Sale, 32 S type 15-plate Chloride batteries with glass boxes complete with stands, charge and discharge switches, meters, &c.—C. J. FERGUSON & SONS, 54, Chiswell Street, London, E.C. 1. 3389

FOR Sale, 40-H.P. Century Motor, single-phase, 200/400 volts, 50 periods, 1400 R.P.M.; also one 20-H.P. Century Motor, 950 R.P.M.; one 15-H.P. Century ditto, 1440 R.P.M.; one 12-H.P. and one 15-H.P. Crypto Motor, 200 volts, 50 periods, 950 R.P.M. Practically new; can be seen running.—6226, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 68-KW., direct coupled, Steam Set, 500 volts, ditto 140 volts.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 3484

FOR Sale, 75 and 110-KW. 220/240-volt. Multipolar-Generators, also several Motors to suit, 7½ to 18 H.P.—THE PHŒNIX ELECTRICAL Co.. 32/36, Broomielaw, Glasgow. 3378

FOR Sale, 100-KW. Belliss-Crompton Generating Set, 500 volts, D.C.; 50-KW. ditto, 240 or 280 volts. Both sets can be seen working by arrangement.—EDMISTON, BROWN & Co., 219, St. Vincent Street, Glasgow. 6174

FOR Sale, 110-KW. direct coupled Steam Generating Set, Siemens type dynamo, 220 volts, immediate delivery.—WILLIAMS AND SONS, 37, Queen Victoria St., London. 3483

FOR Sale, 200 H.P. 3-phase motor, 50 cycles, 500 volts, with bedplate, pulley, resistance and controller. Would exchange for suitable totally enclosed motor.—G. & T. EARLE (1912), LTD., Wilmington, Hull. 3463

FOR Sale, 210-H.P. Motor, 460 volts, 425 R.P.M., with interpoles. 130-H.P. ditto, 500 volts, 650 R.P.M. Prompt delivery.—WILLIAMS & SONS, 37, Queen Victoria Street, London. 3481

FOR Sale, 250-H.P., 500-volt, 50-period, 3-phase Motor, complete with starting gear.—3473, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GENERATING Set comprising 12 N.H.P. Loco. type Boiler with feed water heater; Duplex Steam Pump, 12 N.H.P.; Compound Steam Engine by Davey, Paxman & Co., coupled direct to 200-volt, D.C.; Generator by the Lancashire Dynamo and Motor Co., speed 130 R.P.M., 6-pole type.—STANLEY ENGINEERING CO., Bath. 3443

LAMPS.—108 Flame Arc Lamps (8 "Excello" and 100 "Sunshine"), 46 volts each, 10 amps.; will burn 4 in series 220 or 230 volts direct current; suitable resistances; in good condition.—Apply, WORKMAN, CLARK & Co., LTD., Belfast. 6249

LAURENCE-Scott Motor, 23 B.H.P., 500 volts, compound wound. 540 revs., interpoles, automatic starting and reversing switch, magnetic brake.—JOSEPH PUGSLEY & SONS, LTD., Lawrence Hill, Bristol. 3427

OFFERS wanted for 3000-volt Meter, with potential Transformer; also Ammeter, 0 to 100, with current transformer. Almost new.—6257, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ONE Crompton Dynamo, No. 1922, bi-polar, open type; amps. 65, volts 110, revs. 1260. Also one 5-B.H.P. Westinghouse Motor, serial 120169, D.C. current, shunt wound, 460 volts, 1340 revs. Will take £55 for the two, or would sell separately.—Apply, MARK MAYHEW, LIMITED, Battersea Flour Mills, 112, Church Road, Battersea, S.W. 11. 6085

ONE totally-enclosed Recording Ammeter, up to 100 amp. (by Evershed & Vignoles).—C. J. FERGUSON & SONS, 54, Chiswell Street, London, E.C. 1. 3390

ONE 2-H.P. Mawdsley's Motor, 230-volt, revs. 1350, complete with pulley, starter and bedplate.—Apply HARRY ROGERS, Electrical Engineer, Warrington. 3386

(*Continued on next page.*)

FOR SALE.—*Continued.*

ONE 200-KW. Steam Generating Set for immediate sale, Willans-Mather & Platt, 220 or 440 volts. Perfect working condition.—JENNINGS, West Walls, Newcastle-on-Tyne. 1513

STARTER (one), 200/250 C.C., 15/20 H.P., G.E.C. Never been used. Cheap.—ARCHER, 89, Abbey Road, St. John's Wood, N.W. 8. 6286

STARTERS, semi-enclosed, 12 to 15 H.P., 200 to 500 volts direct, £2 15s. 6d. Warranted perfect order. Approval.—6254, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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60 110-volt Gabriel Carbon Lamps. 40 L Glass Boxes.—MACKWELL, 92, Moulsham Street, Chelmsford. 6247

150-KW., D.C. Generator, multipolar type, 500 volts, with rope pulley; splendid condition.—HARRY H. GARDAM AND CO., LTD., Staines. 2952

190-H.P., six-pole D.C. Motor, by Ernest Scott & Mountain, 500 volts, arranged for rope drive.—HARRY H. GARDAM AND CO., LTD., Staines. 2827

250-KW. Steam Set, comprising Belliss engine, direct coupled to Silvertown dynamo, 500 volts. D.C. Available for prompt delivery.—HARRY H. GARDAM & CO., LTD., Staines. 3435

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STOCKS of Cable, Bell and Lighting Accessories, Lamps, &c., purchased for cash. Large and small quantities.

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GENERATOR AND MOTOR WANTED.

5/6-KILOWATT GENERATOR, D.C. compound.
5-H.P. Motor to suit above. Centrifugal Pump for 3" pipe.
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A 1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

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ONE Fellows Gear Shaper, preferably the No. 6 machine. Must be in first-class condition.—3392, ELECTRICAL REVIEW, 4, Ludgate Hill, London

ONE 200-V., 1-phase, 60 cycles, 5-H.P. Motor.—Particulars to S. E. HUNT, Electrician, 6, The Exchange, Brighton Road, Croydon. 'Phone: 370 Croydon. 6219

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & CO., LTD., 44, Clerkenwell Road, London.

QUANTITY of Flexible Lighting Strip, waterproof, in good condition.—Particulars to HARRIS, 178, High Road, Kilburn, N.W. 6. 6284

SLIP-RING Motor, 3-phase, 25 cycles, 5 H.P., 220 volts, 750 R.P.M., either new or good second-hand. Please state make, price and situation.—3491, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SMALL Motor-Generator Cinema Set, 200-v., 60 cycles, 1-phase, to 50-v., 20 amps., or nearest.—6218, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARTICLES WANTED.—*Continued.*

TWO Megger Sets wanted, new or second-hand.—373, High Street, Smethwick. 6288

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, burnt-out A.C. Motors, over 1 H.P.—MILLARD, Gilbert Road, Belvedere. 6097

WANTED, direct-coupled Set, about 50/75 KW., 220 or 440 volts, D.C., preferably the latter. Full details and price must accompany offer.—2828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, One cwt. 40 S.W.G. Enamelled Copper Wire.—MAGNETOS, LTD., 45, Broad Street, Bloomsbury, W.C. 2. 3373

WANTED, one or two large Motors, from 100 to 200 H.P., 440 volt, D.C.—State particulars to 3340, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, quantity of Cable, 7/14 to 37/14.—6243, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, 70 to 100-H.P., 460-volt, D.C. Motor, complete.—Full particulars, lowest price, &c., to 6310, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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WANTED, 300-H.P., 400-volt, 3-phase, 50-cycle, slip-ring Motor, 325/367 revs.—Full particulars to 3251, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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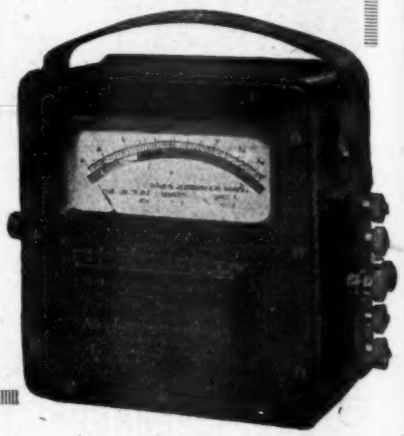

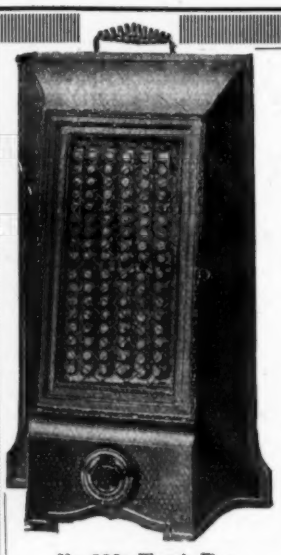

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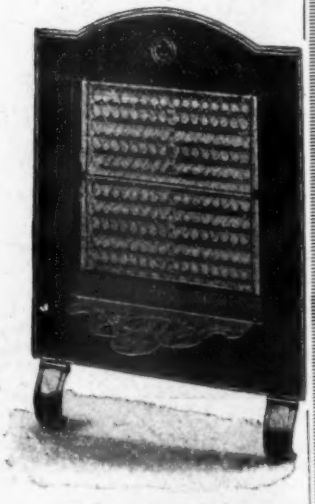

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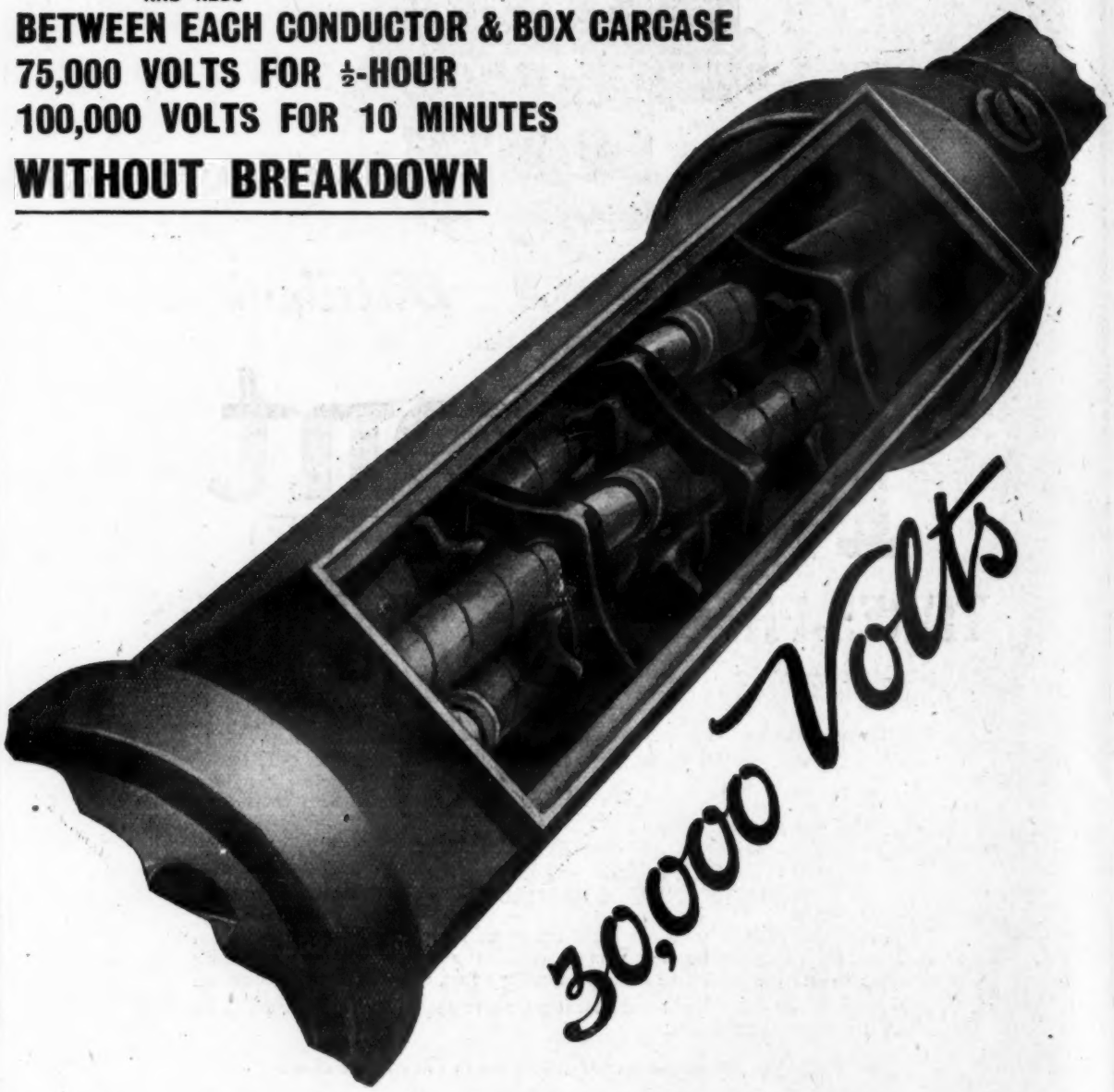

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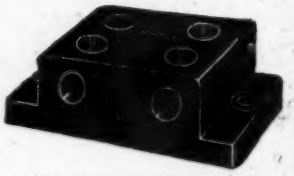

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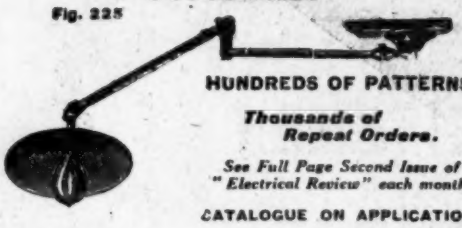

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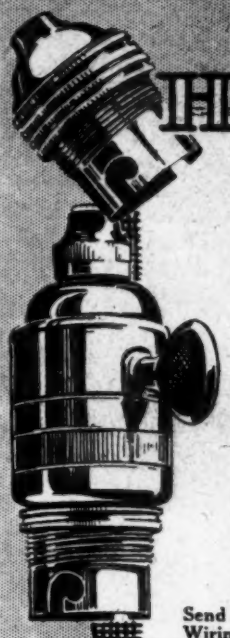

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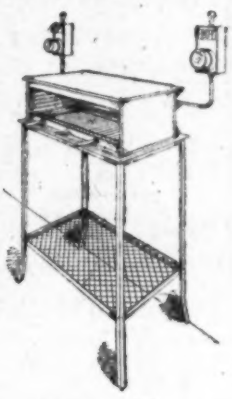

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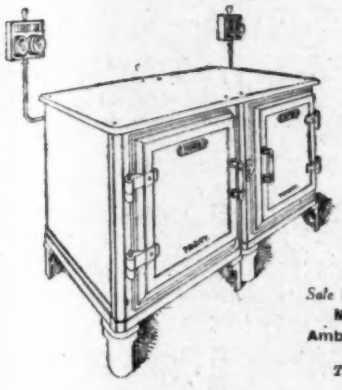

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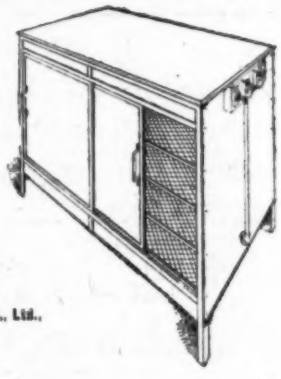

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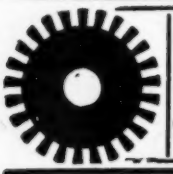

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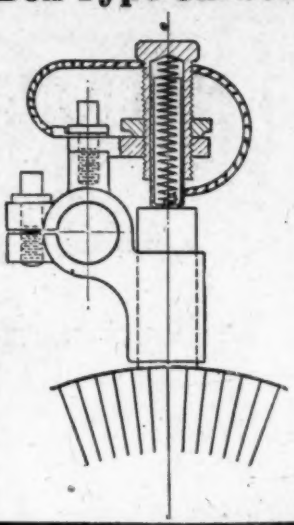

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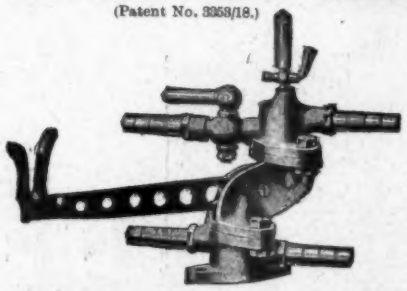

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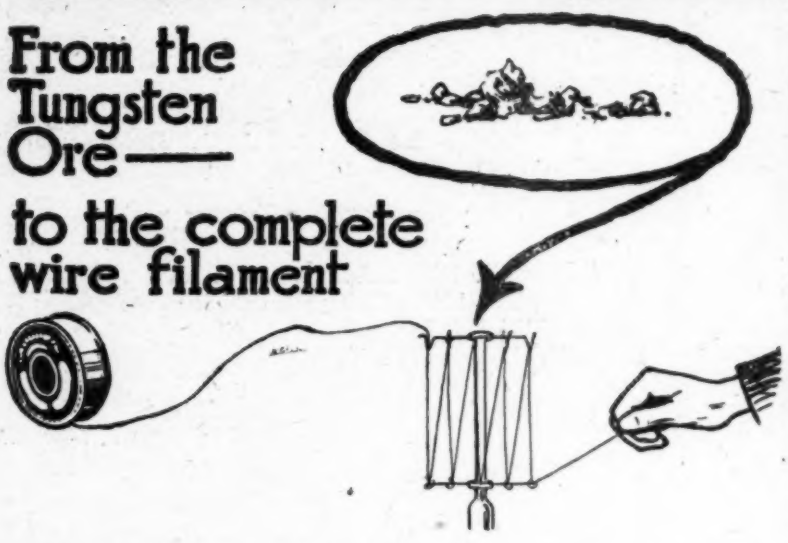

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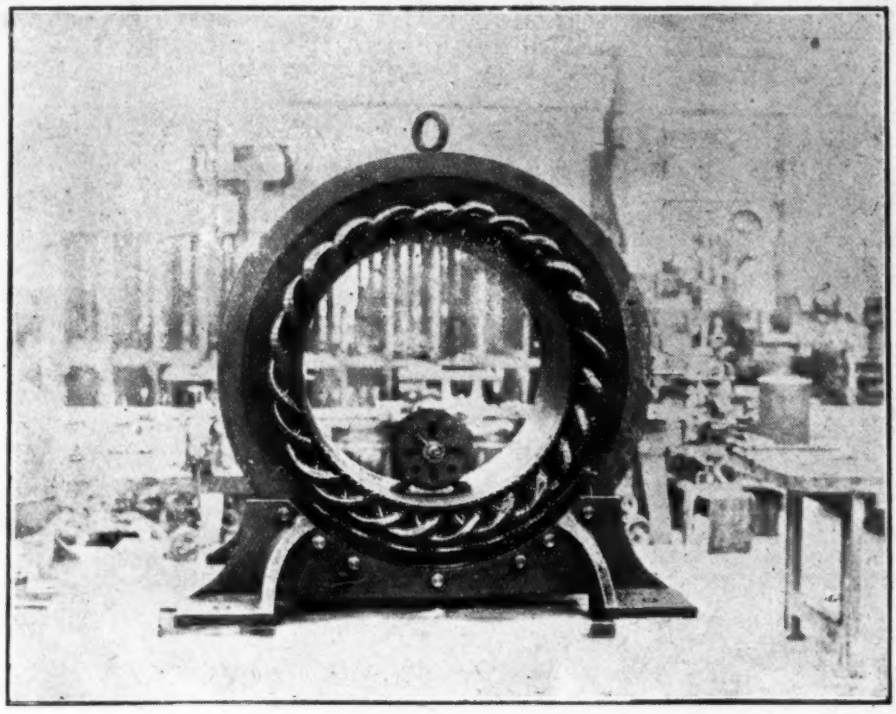

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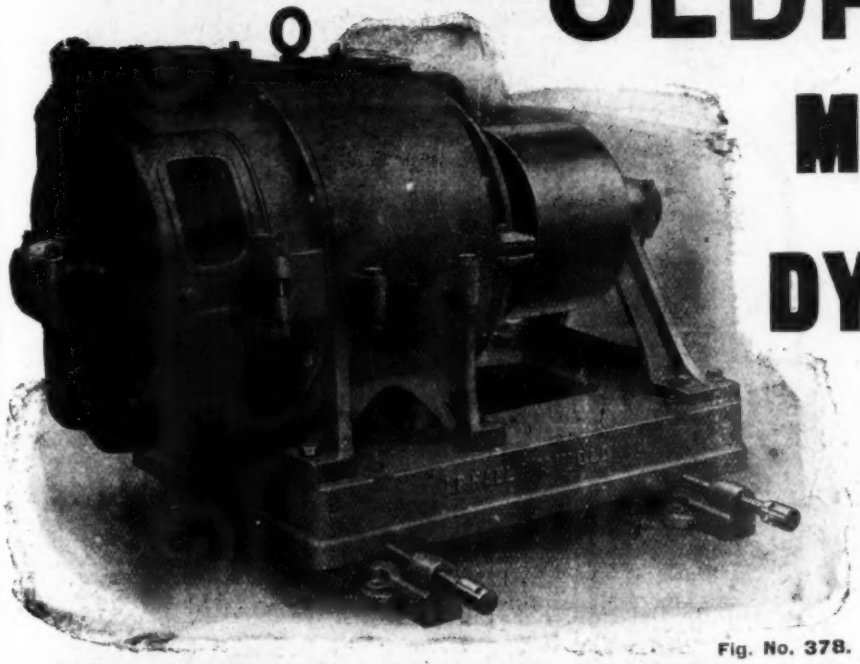

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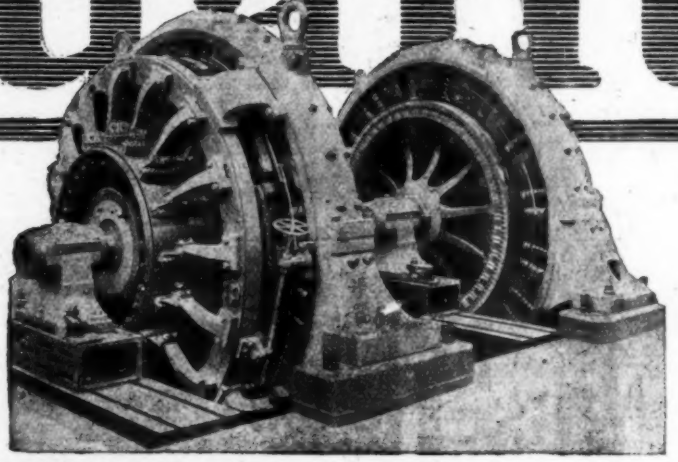

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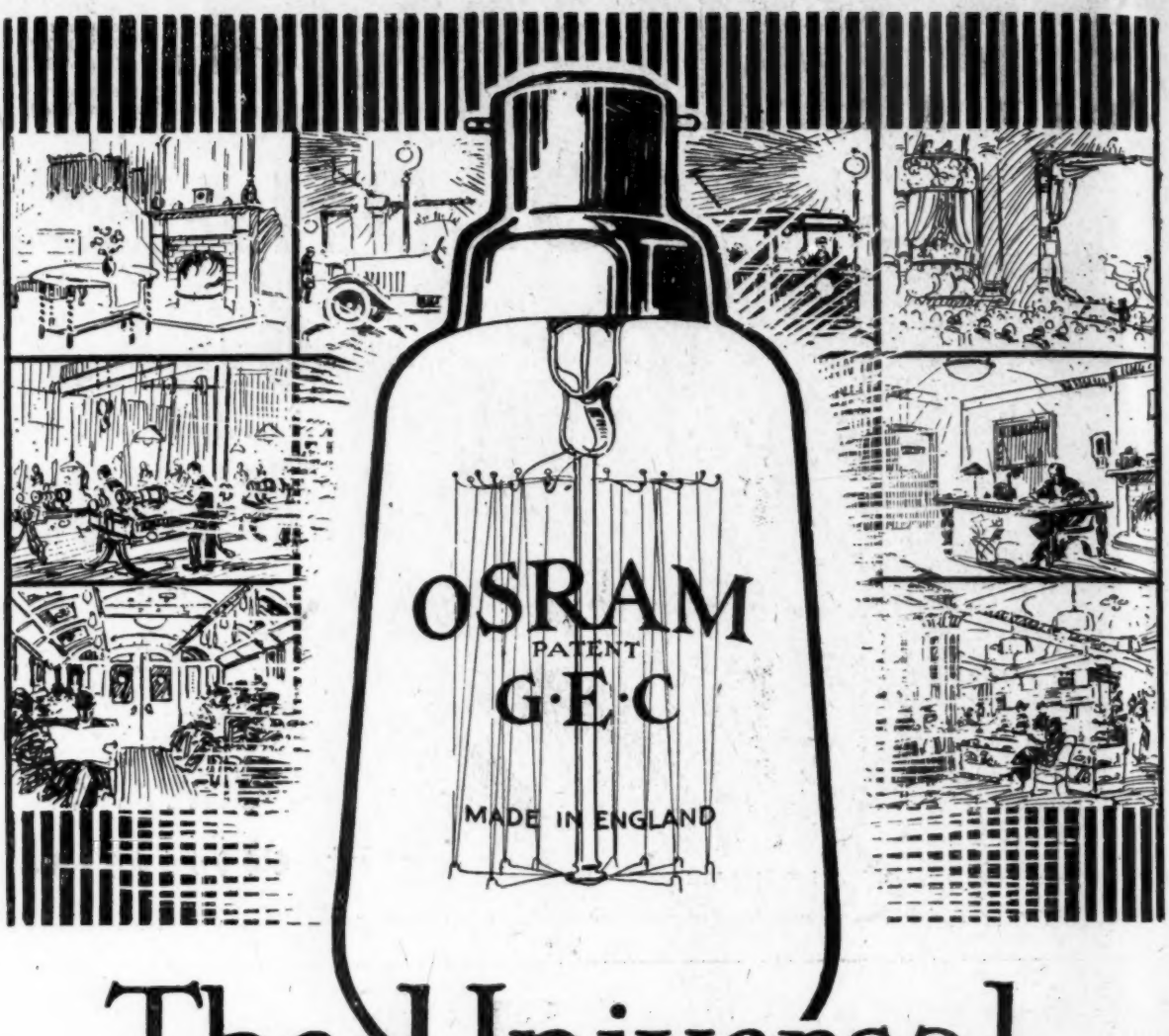

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"The company 'Energia Electrica de Asturias' has almost finished its new hydro-electric plant on the River Aller, near the town of Casomera, and will soon be in a position to supply energy to the extent of 1,900 H.P., and, later on, up to 5,000 H.P. Contracts have been signed for the supply of electric power to various industrial firms, including cement manufacturers, 'Tudela Vequin,' and the coal mine, 'Hullera Espanola.' A reserve steam plant has been erected near the above-mentioned mine for use during the dry season."

GALICIA.—The Governor of Galicia, acting with a group of engineers, has bought from the Germans all the electric plant constructed by the army in East Galicia, on the River Seret, while this was a theatre of war. The German army built an electric power station on the Seret, and constructed a network of high-pressure cables extending from Tarnopol to Borszczow. Transformers set up in towns and villages reduce the pressure to 220 and 110 volts. The energy was supplied either by water or by special steam engines.

SWEDEN.—The question has been to the fore in Sweden whether it would not be advisable to introduce State control of the prices charged for electrical energy. The matter has been before the Royal Waterfalls Board, which has declared the introduction of State control; at the same time, the State is urged to push forward the generation of electricity as much as possible, whereby the State, in a different way, will exercise a certain control over the prices in question.

GERMANY.—Owing to the increase in wages and the price of raw materials and coal, the charge for electricity in Berlin has been raised by an additional 25 per cent., making the total increase 50 per cent. The additional charge according to area is also being raised.

Epsom.—PROPOSED BULK SUPPLY.—The T.C. is considering the question of shutting down its electricity undertaking and purchasing electricity in bulk; there has been a loss of £5,313 on the working of the department during the past three years.

Glasgow.—REFUSE DESTRUCTORS.—The Partick destructor has been transferred to the Electricity Committee, at a value of £6,260.

In view of the cost, the improvement of the electric lighting of the Kelvinhough destructor is not to be proceeded with.

Greetland.—PROPOSED E.L.—The U.D.C. is considering the question of installing electricity for street lighting and other purposes.

Huddersfield.—STRIKE.—On Thursday, last week, the enginemen and stokers at the Corporation electricity works handed in notices to cease work in 48 hours, owing to a dispute over an award of 3s. 6d. per week granted by the Committee on Production. The employés demanded that the award should be operative as from August 10th, and the Corporation offered to date it back to the first pay day in October. This the men refused, and struck work on Saturday night. The Municipal Employés' Association, of which the men are members, advised them to remain at work and submit the matter to arbitration; but this proposal was rejected. On Saturday and Sunday clerks and other Corporation servants took the strikers' places, and the supply was not seriously interfered with.

On Monday the situation became more acute, owing to the demand for energy for power purposes. The supply for lighting purposes was maintained by voluntary labour, but the supply to industrial works had to be discontinued, involving the unemployment of 2,000 persons.

The strike came to an end on Tuesday, when the Wages Committee, in view of the dislocation which had occurred in other industries, decided to grant the men's demands. The strike was conducted against the advice of the Municipal Employés' Association, and the employés who were members have now seceded from that association.

Kingston-on-Thames.—RESTRICTED SUPPLY.—The Corporation has informed its consumers that, "owing to serious machinery difficulties at the electricity works," energy is not to be used for lighting in private houses until 7.30 p.m.

Letterkenny (Co. Donegal).—PROPOSED E.L.—It is proposed to install an E.L. scheme for the town and the local lunatic asylum; the cost is estimated at £2,500.

London.—ST. MARYLEBONE.—YEAR'S WORKING.—The net profit of the B.C. electricity department for the year ended March 31st last was £61, against the estimate of £1,821, and a profit of £6,964 in the preceding year. The report states that, owing to delay in the delivery of the underfeed stokers, the expected economy in fuel was not effected. The two stokers which were fitted, however, and the use of coke breeze during the latter part of the year, checked the upward rise of the cost of fuel. Wages and salaries increased by £2,526, and repairs by £4,290, chiefly due to the renewing of ash-handling plant and economisers, and repairs to pumping machinery, turbines, and converters. The value of apparatus on hire on consumers' premises was £12,888, an increase of about £1,000. The total capital expenditure amounted to £2,149,482, of which £1,662,428 is still outstanding. The revenue for the year amounted to £216,846, compared with £215,034 in the previous year, and the expenditure to £117,320, against £105,790; interest and special charges absorbed £66,091, and repayment of loans £46,503. The generation cost per unit sold was ·783d., against ·684d.; total working cost, 1·323d. against 1·216d.; and the over-all cost, 2·793d., against 2·773d.; the average price charged, excluding meter rents, was 2·59d., against 2·65d. The number of consumers increased from 10,800 to 11,006. The capacity of the plant is 19,000 KW., and the maximum load for the year was 10,817 KW.; 24,451,990 units were generated, against 24,159,759, and 18,387,268, against 17,647,146 were sold.

KENSINGTON.—PRICE INCREASE.—The Brompton and Kensington E.S. Co. has applied to the B. of T. for permission to increase the charge of 13s. 4d. for any quantity up to 20 units per quarter, and 8d. per unit over 20, to 16s. 8d. up to 20 units, and to 10d. per unit above that amount.

Morocco.—The Sociedad Electras Marroqnies has applied for a concession to erect an electric generating station in the city of Arcila. It is proposed to supply three-phase current, at 50 periods, the aerial lines distributing at 500 volts to the transformer stations, where it will be stepped down to 220.

New Zealand.—WATER POWER.—The chief electrical engineer's hydro-electric scheme for the North Island, as submitted to the House of Representatives, provides for three generating stations in the Auckland, Wellington, and Hawkes Bay districts of 96,000, 24.000, and 40,000 H.P. respectively. The total capital expenditure will be £7,599,441, which, it is estimated, will be recoverable in seven years by the amount of coal which will be saved.—*The Times.*

CHRISTCHURCH.—Owing to a recent failure of Lake Coleridge electricity supply, the Council has decided to have plans prepared for the rearrangement of the station and the provision of a stand-by set of about 600 KW.—*B. of T. Journal.*

Stoke-on-Trent.—PRICE INCREASE.—Arising out of the recommendations contained in Sir John Snell's report, the T.C. has adopted a revised scale of charges for electricity, which it is anticipated will increase the annual revenue by £800 or £1,000.

The new charges are as follows:—Lighting, 7d. per unit for the first 73 hours per quarter, and 2½d. per unit beyond; heating and cooking, 1d. per unit; kinemas, 2½d. per unit, less 5 per cent. for payment in seven days; churches, 4½d. per unit. For small power consumers the charge is 2d. per unit up to 250 per quarter, 1½d. per unit between 250 and 500, and 1d. beyond, and for large consumers £1 per KW. per quarter, plus ½d. per unit consumed. All accounts at the general rates are subject to a discount of 5 per cent. for payment within 14 days. The minimum charge is £1 per annum per meter.

Walton-on-Thames.—L.G.B. INQUIRY.—At a L.G.B. inquiry with reference to the cost of electricity, the inspector intimated that he would recommend that the E.L. Co. be allowed to charge 1d. per unit extra, subject to revision at the end of six months.

TRAMWAY AND RAILWAY NOTES.

Argentina.—The Sociedad Anonima Tranvia Eléctrico y Balneario de Quilmes has been formed at Buenos Aires to take over and work concessions granted for the development of Quilmes beach, including an electric tramway system.—*Review of the River Plate.*

Ashover.—PROPOSED LIGHT RAILWAY.—Messrs. T. H. Jackson, G. M. Jackson, and J. Steen have applied to the Light Railway Commissioners for authority to construct light railways from Stretton to Ashover, and from Brackenfield to Ashover.

Birmingham.—PROPOSED EXTENSIONS.—The Tramways Committee has referred to a Sub-Committee the question of constructing tramways in the Selly Oak, Northfield, Longbridge, and Rednal districts.

Bradford.—WAGES.—From December 1st the war bonus of Corporation tramway workers has been increased by 5s. per week for men and 3s. for women, making a total of 30s. and 21s. per week respectively.

Chile.—WATER POWER.—The Government has authorised a private company to erect a transmission line from Los Condes to Santiago, for the purpose of conveying electricity to the amount of 15,000 H.P. from hydro-electric works on the River Mapocho.—*Review of the River Plate.*

Continental.—SPAIN.—Don Luiz Gonzalez de Rivera y Montoro has applied, on behalf of Don Cristino Martos, for a concession for an electric tramway, to run from Castellon to Salon, in the province of Tarragona.

Glasgow.—GOODS TRAFFIC.—The tramway department has decided to experiment with a parcel-carrying tramcar on the Uddington route.

Halifax.—PROPOSED EXTENSIONS.—The B. of T. has extended the time for the extension of certain sections of the Corporation tramways to August 18th, 1919.

Leeds.—WAGES.—From November 1st last the war-wages of tramway workers are to be increased by 5s. per week. This makes the total wages for first-class drivers £3 7s. 6d., and for women workers £2 11s. 6d.

Railway Restrictions.—Season Tickets.—The Railway Executive Committee has withdrawn the restrictions on the issue of season tickets both within and without the 12-mile radius from Charing Cross. Season tickets for over 12 miles to any person not already a holder will be issued for not less than three months, instead of six. Certain concessions will be allowed to those who surrender their tickets before they expire.

Rossendale.—Fare Revision.—The representatives of Bacup and Rawtenstall have agreed to certain fares on the Rossendale tramway system being increased. The system is owned by the Bacup T.C. and leased to the Rawtenstall T.C.

Wages.—In the recent award of the Committee on Production, increasing the war bonus of tramway workers by 5s. per week, it is officially pointed out that the principle of equal pay for men and women was not established.

TELEGRAPH AND TELEPHONE NOTES.

Germany.—The German Government has announced that all the wireless stations have been seized by the Independent Socialists, and declines to accept responsibility for messages.

Italy.—The Pope, says a message from Rome, will ask the Peace Conference to effect a settlement between the Vatican and the Quirinal. He desires greater liberty of movement, and the installation of wireless at the Vatican to enable him to communicate with foreign Governments and the Papal nuncios without using the Italian telegraph lines.—*Daily Sketch.*

United States.—Mr. Theodore N. Vail, president of the American Telegraph and Telephone Co., is to advise the United States Postmaster-General in regard to the organisation of the telephone and telegraph systems under Government control.—*The Times.*

Reuter messages state that the Postmaster-General has authorised the amalgamation of the Western Union and Commercial Cable Companies and the marine cable systems under the direction of Mr. Ward, the vice-president of the Commercial Cable Co.; and that the Commercial Cable Co. has brought a suit to enjoin the P.M.G. from assuming control of the company's cables.

Wireless Telephony.—According to the *Daily Chronicle*, Mr. Godfrey Isaacs recently said that wireless telephony from here to New York might be contemplated in the near future. At present commercial developments were held up owing to Government control, but when the need for this had passed, wireless telephony was expected to take a big part in the conduct of the world's commerce. "I don't think we need be limited by distance at all," Mr. Isaacs said, "and as soon as our hands are free and we can get on with the work, there is no reason why we should not be able to introduce a wireless telephone between here and New York or Buenos Aires, or even Australia, 12,000 miles away."

CONTRACTS OPEN AND CLOSED.

OPEN.

Bootle.—Corporation. Supply of ½-watt-lamp street lighting equipment (4 miles) for tramway routes. Mr. T. D. Clothier, Borough Electrical Engineer.

Leeds.—Extensions to boiler house, switch rooms and circulating pump house at the Electricity Works, Whitehall Road. Mr. G. W. Atkinson, 1, Mark Lane, Leeds.

Spain.—The municipal authorities of Ocana (Province of Toledo) have lately invited tenders for the concession for the electric lighting of the town.

Warrington.—December 10th. Corporation Electricity Department. 10,000 or 20,000 tons of slack coal. Mr. F. V. L. Mathias, Engineer (returnable deposit of £1 1s.).

CLOSED.

Stepney.—The Electricity Committee has accepted the following offers of coal: Bradbury, Son & Co., 5,000 tons, at from 27s. 9d. to 30s. 1d. per ton; E. Foster & Co., 13,000 tons, at from 27s. 4d. to 28s. 7d. per ton; A. Blackman & Co., 80 tons slack, at from 23s. 3d. to 27s. 1d. per ton.

Willesden.—U.D.C. Ransomes, Sims & Jefferies, Ltd. Three 2-ton electrically-operated tipping wagons, at £1,151 each.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, December 7th. Visit to the Union Coal Storage Co., Ltd.

Saturday, December 7th. At the Royal Technical Institute. At 7 p.m. Annual meeting.

London Association of Foremen Engineers.—Saturday, December 7th. At 7 p.m. At the Cannon Street Hotel, E.C. Annual meeting, election of officers, &c.

Chief Technical Assistants' Association.—Saturday, December 7th. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Discussion on "Testing of Plant."

Junior Institution of Engineers (North-Eastern Section).—Tuesday, December 10th. At the Mining Institute, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Pumps, Condenser Systems, &c.," by Messrs. T. W. Stewert and H. J. Aldis.

(North-Western Section).—Monday, December 9th. At the Manchester Photographic Society. At 7.30 p.m. Paper on "Pressure Gauges," by Mr. G. A. Napier.

Industrial Reconstruction Council.—Wednesday, December 11th. At the Saddlers' Hall, Cheapside. At 4.30 p.m. Lecture on "Science and Industry," by Sir W. S. McCormick.

Institution of Electrical Engineers.—Thursday, December 12th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on "Electric Welding."

(North Midland Centre).—Tuesday, December 10th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

(North-Western Centre).—Tuesday, December 10th. At the Engineers' Club, Manchester. At 7 p.m. Address by the President, Mr. C. H. Wordingham, C.B.E.

(Scottish Centre).—Tuesday, December 10th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Use of High-pressure and High-temperature Steam in Large Power Stations," by Mr. J. H. Shaw.

(Irish Centre).—Friday, December 13th. At the Royal College of Science, Dublin. At 7 p.m. Paper on "Heating," by Mr. S. L. R. Price.

Electro-Harmonic Society.—Friday, December 13th. At 8 p.m. Smoking concert at the Holborn Restaurant (Venetian Chamber).

Manchester Association of Engineers.—Saturday, December 14th. At 6.30 p.m. At the Grand Hotel. Paper on "Wood Testing," by Mr. J. E. Hurst.

Birmingham and District Electric Club.—Saturday, December 14th. At the Swan Hotel. At 7 p.m. Annual general meeting.

NOTES.

Electric Power Supply and the Election.—At a meeting of the Electrical Section of the Newcastle-on-Tyne Chamber of Commerce, last week, it was resolved that Mr. Herbert Shaw should send a letter to each local candidate for the coming Parliamentary elections, making the following inquiries:—

1. Do you agree with the policy of extensive development in the supply of electric power as a means of increasing production from the home industries, and thereby improving the prosperity and welfare of the people? In which case, are you prepared to press forward immediate legislation to give effect to the necessary reform?

2. What are your views upon the recommendation of the Board of Trade Committee on Electric Power Supply (Report Ref. Cd. 9062/1918)?

or the alternatives—

1. State ownership and control.
2. Municipal ownership and control.
3. Ownership and control by private enterprise.
4. State ownership leased to private enterprise for operation.

Volunteer Notes.—Royal Engineers (Vols.), London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 50, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Sunday, December 8th.—The competitions between the Companies will be held at Esher Bridge.
Monday, December 9th, to Saturday, December 14th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Waste of Fuel.—A correspondent ("U.S.A.") writes to draw attention to a direction in which will be found coal wastage to a very serious extent. He refers particularly to temporary installations of steam plant, especially those of small contractors and second-class firms, who are almost invariably associated with very inefficient steam engines, such as steam cranes and winches, direct-acting steam pumps, pile-drivers, and well-sinking and drilling plants. The boilers used are usually of the less efficient types, often of that worst and most wasteful order, the small vertical type. Such installations are rarely well set up to begin with, and leaking joints are often met with; to render wastefulness complete, the boiler, the steam pipes, and the engine cylinders are exposed to wind and weather, and not the least trouble is taken to guard against loss of heat by insulating any portion. He ran against one of these wasters not long ago, who professed to be an engineer—"an example of that misuse of the term engineer which ought not to be possible or allowed to men with not a spark of the spirit which ought to actuate every man who so describes himself. Such wasters of fuel ought to be controlled. The coal they waste may easily run up to 100 or even 200 tons annually on a single small plant."

We hope to see something done by the Coal Controller to limit the extravagance which goes on in the directions indicated, amongst others. Few have any idea of the enormous excess of fuel consumption by plant of uneconomical types carelessly put together, carelessly worked, and wholly unprovided with protection against loss of heat.

Institution and Lecture Notes.—Electrical Power Engineers' Association.—A meeting of the Dundee Section of the Association was held at Lamb's Hotel on November 23rd, for the appointment of a Committee for the ensuing year. Owing to the near formation of the Scottish Division (December 1st), Mr. Holt, Hon. Assistant Secretary, Northern Division, Manchester, travelled North to address the meeting. Mr. Wright took the chair and introduced the speaker. Before a good attendance Mr. Holt delivered an excellent address on the Association's affairs to date.

At the Synod Hall, Edinburgh, on November 25th, the formation of this Section took place. The chair was taken by Mr. Wright, Dundee Interim Publicity Secretary, Scotland. Mr. Holt, of Manchester, gave an interesting *résumé* of the doings of the Association from its inception. A representative attendance of engineers was present, among whom were several local chief engineers. After the appointment of a Committee the meeting was thrown open to discussion.

Institution of Electrical Engineers.—A meeting of the Institution will be held at the Institution of Civil Engineers, at 6 p.m. (light refreshments, 5.30 p.m.), on Thursday, December 12th, to discuss the subject of "Electric Welding." Copies of "Notes on Arc Welding Regulations" (by Mr. H. M. Sayers) can be obtained on application to the secretary. It is not intended, however, to limit the discussion to "Regulations," but that it should cover "Electric Welding" in general. Those wishing to take part in the discussion are invited to send their names to the Secretary before the meeting, if possible.

The syllabus of meetings for the new session of the SCOTTISH CENTRE, which opened on November 12th at Glasgow with the chairman's inaugural address, contains the following:—

December 10th (Glasgow).—"The Use of High-Pressure and High-Temperature Steam in Large Power Stations," by Mr. J. H. Shaw.
December 16th (Glasgow).—Visit of President, Mr. C. H. Wordingham, C.B.E.
January 14th (Edinburgh).—"The Supply of Single-Phase Power from Three-Phase Systems," by Prof. Miles Walker.
February 11th (Glasgow).—"Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.
February 25th (Glasgow).—"The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field.
March 11th (Edinburgh).—Ordinary meeting.
April 8th (Glasgow).—Annual general meeting.

Leeds Association of Engineers.—A lecture was given by Prof. G. F. Charnock, of the Bradford Technical College, on Friday last, on the reports of the Coal Conservation Committee and the Board of Trade Committee on Electricity Supply. The lecturer, while agreeing with the principles set forth, complained of the lack of details in the reports, and said the Government should institute further inquiry before the matter was taken before Parliament for consideration. No national scheme of coal supply conservation would be complete without some economical provisions for heating. Electric heating, he affirmed, was not practicable, at least, for manufacturing purposes. Mr. W. B. Woodhouse, of the Yorkshire Electric Power Co., advocated the institution of big supply stations in centralised positions. Only by such means could labour and fuel be saved.

Liverpool Engineering Society.—At a meeting on Nov. 20th, an address on "Education in Relation to Industry, with Particular Reference to Engineering," was given by Mr. Algernon E. Berriman, O.B.E. The lecturer, whose aim was to assist the work of the Engineering Training Organisation, premised that industry required its higher staff to be educated both in the theory and in the practice of its operations, and that the two-part education could not be provided solely by experience in the works or solely by a college course. Further, that applied science was now so far advanced that any attempt to acquire full theoretical knowledge solely by spare-time work was liable to jeopardise health, and was certain to result in the neglect of those proper human interests that were an essential part of a broad education. Broad education was essential to success in any position of responsibility in industry. Time off from work for the purpose of study was, therefore, an essential principle of industrial education, and should be applied to all, without distinction of class, in order that industry might choose leaders from the widest possible field. Theory was best studied by most students under organised tuition in the form of part-time "classes" or a whole-time "college course." In general, higher education was only available in the latter form, and the "college course" thus became identified with the higher grade of industrial training, and in particular should this assistance be regarded as a virtual necessity by those who set out from the start to acquire the status of an engineer. With these premisses, the author dealt in detail with the training of boys of all grades of ability.

Institution of Mechanical Engineers.—Owing to the elections, the meeting on December 13th has been abandoned. The next meeting will be on January 24th, when a paper on electric welding will be read by Mr. T. T. Heaton.

Physical Society of London.—At the meeting held on October 25th, a discussion took place on "The Case for the Ring Electron." Dr. H. S. Allen discussed the arguments in favour of an electron in the form of a current circuit capable of producing magnetic effects. Then the electron, in addition to exerting electrostatic forces, would behave like a small magnet. The assumption of the ring electron removed many outstanding difficulties, including the following:—

There is no loss of energy by radiation as in the case of a classical electron circulating in an orbit.

Diamagnetic atoms must have a zero resultant magnetic moment. This is difficult to account for with electrons in orbital motion.

The ring electron gives a good explanation of the facts of paramagnetism.

The asymmetry of certain types of radiation can be accounted for.

The forces of cohesion in a solid are similar in nature to chemical forces, both sets of forces having an electromagnetic origin.

The questions of the mass and magnetic moment of such a ring electron were discussed. It was pointed out that the adoption of this hypothesis would lead naturally to the acceptance of an atomic model with a magnetic core, as previously suggested by the speaker.

Dr. D. Owen said that the evidence, on the whole, scarcely impressed him as convincing. Whilst from the point of view of certain phenomena a strong case might be made for its acceptance, it seemed equally true that in regard to other phenomena a strong case might be made against it.

Prof. Hale (of Mount Wilson Observatory) referred to some solar phenomena which were of interest in connection with the theory.

The general magnetic field of the sun was so small that the total displacement of spectrum lines was only about 1/1,000 A.U.—*i.e.*, the maximum intensity was about 50 units. Its polarity was the same as that of the earth, and the magnetic poles were 6½° from the axis. The field diminished rapidly above the surface. It was undetectable at a height of 1,000 to 2,000 miles.

At the meeting held on November 8th, a paper on "Low-Voltage Arcs in Metallic Vapours" was read by Prof. J. C. McLennan, F.R.S. The paper described experiments by Messrs. Hamer and Kemp, students of the author's, at Toronto University. The experiments showed that increasing the temperature of the incandescent cathode lowered the voltage necessary to produce arcs in the vapours of mercury, zinc, and cadmium. With mercury it was found possible to strike arcs with voltages as low as 4·75 volts, and to maintain them at 2·84 volts. Corresponding figures for cadmium were 5 and 2 volts. To obtain these very low arcing voltages it was necessary to use intensely hot cathodes and a copious supply of highly heated metallic vapour.

Electricity in Reconstruction.—In a letter to the *Times Engineering Supplement* for November, Mr. S. E. Fedden pointed out that the industrial reconstruction of Britain, both immediately after the war and during the subsequent period of from five to ten years, was bound up with a plentiful supply of electric power being available with the least possible delay at the existing industrial centres. A very large amount of manufacturers' private steam and gas power plant, he said, was on the point of breakdown through the strain of continuous day and night working during the last 4½ years, and through inability to find time and labour to maintain it in proper repair. Within a short time it would be necessary to scrap this worn-out plant and quickly replace it by electric motors. The aggregate horse-power for this work alone would be hundreds of thousands, and further huge supplies would be required for the equipment of new works and extensions of existing works.

Steps should be taken at once to equip the power stations of the country with the necessary generating plant to supply the increased demand for electricity; big electrical generators took from two to three years to manufacture and install, and he suggested that the Government should forthwith place on order 25 generating sets, each of 25,000 KW. capacity, with the necessary boilers and accessories. The orders should be allocated with a view to the most expeditious completion of the contracts and according to the capacity for production of each particular firm. The orders would provide employment for a vast amount of machinery and for thousands of workmen during the interregnum between the cessation of war production and the time when general reorganisation rendered it possible to résume the industries of peace times.

If this scheme could be put in hand at once, the manufacturers of the country would be assured of an ample supply of power at reasonable rates, at a time when the need would be most apparent. Further, the adoption of this or any similar idea need not in any way prejudice, but could be made complementary to, the large Government schemes for the wholesale supply of electricity foreshadowed in the various reports which had been issued. The one purpose of the suggestion was to avoid any possible delay in the provision of abundant supplies of electricity, which, in Mr. Fedden's opinion, were vital to the best interests of the community at large.

Ramsay Memorial Fund.—The hon. treasurers of the Ramsay Memorial Fund announce that it is now just over £40,000. The aim of the appeal was £100,000. Contributions may be sent to the hon. treasurers, Lord Glenconner and Prof. J. Norman Collie, at University College, Gower Street, W.C. 1.

Parliamentary.—*Applications for Powers.*—The following notices of applications for powers have been published in the *London Gazette*:—

Shrewsbury.—Shrewsbury and Market Drayton Light Railway Co. New company to construct light railways, &c.

Oldham.—Corporation. Powers to construct new tramways in the borough and urban district of Chadderton.

Thornaby-on-Tees.—Corporation. Powers to construct new tramways.

Patent Regulations Revoked.—Paragraph 18 B of the Defence of the Realm Regulations, relating to the prohibition of publication of inventions and designs and the filing of applications for the grant of patents and registration of designs abroad, has been revoked.

Royal Naval Division: Relief Committee.—A Relief Committee was formed in November, 1914, in connection with the Divisional Engineers of the Royal Naval Division by members of the Institution of Electrical Engineers, in whose premises the recruiting was carried out, assisted by members of the Institutions of Civil and Mechanical Engineers.

Necessitous cases, mainly due to delay in the payment of separation allowances, were at first investigated and relieved by the Soldiers' and Sailors' Families Association. The late Mr. Wm. Duddell took an active interest in this. A fund was subscribed in anticipation of further need for assistance, but the Divisional Engineers afterwards became dispersed, and while nominally belonging in some respects to the Royal Naval Division, ceased to exist as the Divisional Engineers.

Meanwhile, the Royal Naval Division Comforts Fund, with offices at 11, St. James's Square, S.W. 1, had been actively engaged in sending food to Prisoners of War in Germany, and is now winding up its organisation with a financial deficit.

The surviving members of the Committee and contributors to the Divisional Engineers' Fund have agreed to hand the balance over to the Royal Naval Division Comforts Fund, and the sum of £31 18s. 2d. has accordingly been thus dealt with.

International Research.—The *Times* states that at the second meeting of the Conference of Inter-Allied Scientific Bodies, at Paris, it was decided that the Conference should provisionally fulfil the *rôle* of International Research Council, the creation of which was voted at the Inter-Allied meeting in London.

The Electrical Contractors' Association.—On and after the 9th inst. the address of the three Associations, namely :—The Electrical Contractors' Association (Incorporated), the N.E.C.T.A., Ltd., and the National Federated Electrical Association, will be 11 and 13, Southampton Row, W.C. 1, instead of 20, Bucklersbury, London, E.C. 4. The new telephone number will be Museum 4088, and the telegraphic address will be "Nafecta Phone London." Owing to the increased work of these three Associations, the Council has decided to have its own offices, and has come to an agreement with Mr. Leonard G. Tate, the General Secretary, to devote his whole time to the work of the three Associations.

A New Governor.—In *L'Industrie Electrique* for September 25th M. J. Barbillion gives particulars of a new speed regulator depending for its action both on the amount of departure from the normal speed and on the rate at which the speed is changing. In principle (see figure) it consists of a centrifugal speed indicator A and an acceleration indicator B, to both of which is connected a lever C, at the points *a* and *b*. A link coupling the lever to a servomotor which controls the sluice gates or valve gear is adjustable in a slot at *c*. When the speed of the machine rises, the end *a* of the lever is lifted in proportion to the change of speed, and the end *b* in proportion to the rate of change; if the speed is too high and rising, *a*, *b*, and *c* are lifted, and the servomotor is set in operation to close the valve; if the speed is too high but falling, *a* is raised but *b* is lowered, and whether *c* is raised or lowered depends upon its position in the slot and the relative movements of *a* and *b*. Similarly when the speed is low, the movement of *c* depends upon all three factors, and owing to the introduction of the acceleration

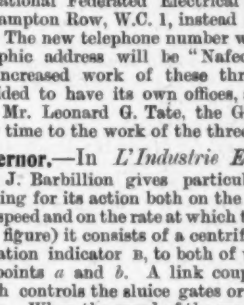

Diagram of Regulator.

factor, the action of the regulator is not only very rapid when necessary, but also very "judicious." It can be shown, says the author, that with this arrangement theoretically perfect regulation is attainable, and speed oscillations are completely suppressed. Regulation is very rapid, and the adjustment to maintain a given speed is very easily made, either by hand or automatically. In the figure D is the pilot valve of the servomotor E, and it will be seen that the position of *c* in the slot is controlled by the position of the valve gear or sluice gate.

State Help for Universities.—Mr. Bonar Law and Mr. H. A. L. Fisher recently received at the Board of Education a large and representative deputation from the Universities and Institutions of University rank of Great Britain and Ireland, which desired to lay before the Government the need for further financial assistance to enable the Universities to maintain the standard of their work and to develop their activities.

The Chancellor of the Exchequer, in replying to the deputation, said that the Government was fully alive to the vital importance to the nation of maintaining the efficiency of the highest education in the country, and promised that he would consider sympathetically any recommendations which might be made to him by the President of the Board of Education.—*The Times.*

The E.T.U. in a New Guise.—At a meeting held in the Albert Hall on Sunday last, at which Mr. Lansbury presided, according to the *Times* report, Mr. Robert Williams (National Transport Workers' Federation) said that no insurrectionary or revolutionary movement could be conducted successfully by any single section of the working class. If the Electrical Trades Union were prepared "to go over the top" they would require millions of effective reserves. The time might come during the next month, or six months, when some Union might be called upon to take considered and determined action in the interests of the working classes, and that Union might require the assistance of every other Union in London. It was not a matter of cheering for the revolution—it was what they were going to do for the revolution.

The Coal Shortage.—Figures issued by the Coal Controller show a further serious falling-off in the estimated output of coal during the first 40 weeks of this year, compared with the output during the corresponding period of last year. The net shortage is nearly 16½ million tons, or about 8·4 per cent. Although miners will shortly be returning to the mines at the rate of 5,000 a day, there is a large leeway to be made up, and some little time must elapse before the increase in the output of coal is felt.

Electroculture.—According to the *Daily Chronicle*, a row of savoys of enormous dimensions has been grown from electrified seed by Mr. W. Guy on an allotment at Parkstone. It is stated that one plant measured 4 ft. 1 in. across, and weighed 12½ lb.

Electrolytic Extraction of Copper from Pyritic Ashes.—A new method for the electrolytic extraction of copper from pyritic ashes was described in *l'Industria* for July 15th. The method is based on the electrolytic conversion of sulphide or sulphate of copper into cupric or cuprous chloride by the action of chlorine at the anode. If in an electrolytic bath containing hydrochloric acid in solution the anode is surrounded by a mass of pyritic scoria, the chlorine liberated by the hydrogen attacks the oxides, sulphates, or sulphides of copper more rapidly than the oxides of iron, and combines with them to form cupric chloride. This reaction extends to the entire mass of scoria, so that the latter acts as an electrode. The copper loss by this method is said to be only 0·1 per cent.

Demobilisation in Germany.—"The main principle of demobilisation, according to *Vorwärts*, will be that: 'Every wage-worker and official shall return to the situation which he had in 1914.' This general principle shall also apply to the demobilisation of the 'home army, several hundred thousands of whom will be left without employment by the closing down of concerns which are working solely on war contracts.' Of course the principle—'Back to your old situation'—will not be rigidly applied, but due care will be taken to avoid unnecessary changes and personal inconvenience. No foreign workman shall be allowed to deprive a German of work and food. Facilities will be given to Polish, Belgian, and Dutch workmen to return to their homes. The reinstatement of the workers in their old employment will doubtless be seriously interfered with, by the fact that many concerns have been closed down. Labour Exchanges, unemployment benefit, and public relief works will help to solve any difficulties arising in this way. There will be no great difficulty in establishing public relief works of permanent economic value. There is no lack of opportunities for work. An enormous amount of repairing work is urgently required. But it is very questionable if contracts for the requisite installation work will be distributed so long as prices remain at their present height. A dangerous vacuum may arise owing to want of coal and raw material, and it will be the duty of the Imperial Authorities to make the necessary provision. Deliberations are still in progress regarding these questions, and the elimination of profiteering from public contracts. Soldiers will be discharged according to the economic value of the trade to which they belong. At the same time special facilities will be given to employers for obtaining the release of particular men, and it seems probable that they will be controlled by trade union secretaries in the exercise of these facilities. The organisation for demobilisation will be devoid of all bureaucratic formality. It will be guided by the advice of the existing industrial associations, and will depend on the energy, discretion, and sense of responsibility of the officers of these associations, who will be entrusted with full powers to make all the necessary arrangements without loss of time. The Imperial Economic Department is at the head of this organisation, and the work will be divided up among local committees, who will also have extensive powers. Industry as a whole will have to bear part of the social burdens of demobilisation. It is possible that the periods for terminating agreements will be extended, or regulations will be made regarding the rates of wages and the hours of labour."—*Labour Gazette.*

Conductivity of Aluminium Conductors.—According to a new regulation published by the Ministry of Public Works in Austria on August 21st, 1918, it is now permitted to use aluminium conductors of lower conductivity than was specified in the regulations in force hitherto. The highest limit for the resistivity is now 31 ohms for an aluminium wire of 1,000 m. length and 1 sq. mm. section at 15 deg. C. instead of 20 ohms, as previously specified. The change is necessitated by the impossibility of meeting the earlier specification with the grades of aluminium now obtainable on the market. —*Elektrotechnik und-Maschinenbau.*

The Premier on Reconstruction.—The Prime Minister opened the provincial campaign of the Coalition by addressing a big meeting at Wolverhampton on Nov. 23rd. He said that in preparing for a new policy we must sweep aside prejudices. He was afraid more of vested prejudices than he was of vested interests. A systematic effort must be made to bring the population back to the land, and an intelligent agricultural policy was the true basis of a great industrial policy. The land must be cultivated to its fullest capacity; that should be an essential feature in the new Britain.

Above all, we must have an improved system of cheap and rapid transportation if we were to carry out the agricultural policy. He might go into that later on, because he attached great importance to it. We must have good services, tramways, light railways, lorries, and whatever enabled people and goods to pass along great spaces in order to make use of the surface of the land. Before the war, agricultural produce could be got from foreign countries hundreds of miles away, more cheaply than the farmers could bring it 50 miles to a market. With a cheap, quick transportation, England could be regenerated in a way which could not be done by any other means, and he considered, therefore, that meant one of the most important of matters. He would also like to develop the importance of canals. The Midlands ought to have canal communication with the sea. In Germany, in France, great towns and cities would certainly be in communication with the main waterways that communicated with the sea. There was no country that had made less use of its water power. There was plenty of water in this country, that was not what we were short of, and we had got the canals.

British Scientific Products Exhibition.—In view of the wide public interest taken in this exhibition, held at King's College, London, during the past summer, the British Science Guild has decided to organise another exhibition next year. The main object of the exhibition will be to stimulate national enterprise by a display of the year's progress in British science, invention, and industry. Further particulars will be available in due course. A large part of the recent exhibition has been transferred to Manchester, where it will be on view at the Municipal College of Technology towards the end of this month.

Training for Officers.—A Committee to be known as the Officers' University and Technical Training Committee for Scotland has been appointed by the Ministry of Labour, to advise the Scotch Education Department, the Board of Agriculture for Scotland, the Ministry of Pensions, and the Ministry of Labour, as to what course of education and training it may be desirable to arrange for the benefit of officers and ex-officers of His Majesty's Forces and men of like standing, particularly with a view to finding for them suitable employment after the war. The work of the Committee will be closely associated with that of the Appointments Department of the Ministry of Labour. The Committee will be under the chairmanship of Sir Alfred Ewing, Principal of Edinburgh University, and the secretary is Major G. F. Young, of the Appointments Department, Ministry of Labour, Balmoral Hotel, Princes Street, Edinburgh, to whom any communications in regard to the work of the Committee should be addressed.—*Daily Telegraph.*

The Fleming Valve.—In the Chancery Division the petition of Dr. J. A. Fleming for the prolongation of his patent No. 24,850, 1904, for "Improvements in Instruments for detecting and measuring alternating electric currents"—the well-known "valve" used in wireless telegraphy—came on for hearing before Mr. Justice Sargant on Wednesday. There were several objectors. The case is proceeding.

Coal Economy.—At the Royal Technical College at Glasgow on November 16th, Mr. David Wilson, technical adviser to the Coal Controller, delivered an address before the Association of Mining Electrical Engineers and Colliery Managers on the subject of coal economy so far as it applies to collieries. He explained that up to the present collieries had not been included in the economy campaign; first, because no transport was involved; and secondly, because collieries used, or rather, should use, very low-grade coal. He had, however, now received instructions from the Coal Controller to include collieries in his investigations. Whilst there were many efficient collieries in the country, it was a fact that collectively the inefficiency of the steam-generating plant was notorious—due, no doubt, to the fact that coal costs had been of little or no relative importance—and some plant had been so neglected that reconstruction or electrification was the only ultimate solution.

The total coal raised in the British Isles during 1917 was 248,000,000 tons, and the consumption at collieries about 18,000,000 tons. According to the Coal Conservation Committee, complete electrification of all collieries would result in a saving of 75 per cent., reducing the above figure to, say, 5,000,000 tons—thereby releasing 13,000,000 tons per annum for use elsewhere. It would be said that the coal used at collieries was not worth sending out to industrial firms. Mr. Wilson maintained that if they could raise steam with it, other people could do the same, although, of course, from a national point of view it would not be economical to send the very low-grade coal to firms remote from the pits. Whilst complete electrification would no doubt be the ultimate solution of colliery inefficiency, they recognised that owing to the difficulty of obtaining materials, very little could be done in that direction at the present time. In order to get some up-to-date evidence of the relative efficiency or inefficiency of collieries, he had recently investigated on behalf of the Controller, 24 selected cases in England. He exhibited tables showing the estimated saving which should be immediately possible—first, without any additional plant; secondly, by electrification; and thirdly, by installing new plant other than that required for electrification. He showed that the consumption of coal used under the boilers varied from 4.5 per cent. to 16.5 per cent. of the total production, the average being 9.5 per cent., and that the annual saving for only 24 collieries was estimated at 10,486 tons, or 97,666 tons if electrification was included. He did not suggest that a pro-rata saving would be possible for the 3,000 odd collieries in the British Isles, but he believed a figure of one million tons would certainly not be a high estimate, and a possible saving of 12 million tons per annum if all collieries were electrified.

Mr. Wilson then enumerated the principal reasons for the low efficiency of the steam plants at collieries, and distributed copies of his address (see Elec. Rev., October 25th, 1918, p. 406) recently delivered before the Association of Engineers-in-Charge, in which definite suggestions regarding the operation of power plant were set out.

Appointments Vacant.—Working foreman to inspect consumers' installations, &c. (91s.), for the Salford Corporation Electricity Department; manager and engineer (£400), for the Mexborough and Swinton Tramways Co.; charge engineer (£191), for the City of York Electricity Department; chief instructor for the Ceylon Government Technical Schools (£450 to £600). See our advertisement pages to-day.

For Sale.—The Edinburgh Corporation Electric Supply Department has for sale two Bellis engines and one Willans engine coupled to Siemens dynamos; the Central Electric Supply Co. has for sale one 1,050-kw. Oerlikon turbo-generator and one Richardsons, Westgarth condenser, with air pump and circulating pump.—See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Ilford U.D.C. Electricity Committee has recommended that the salary of Mr. Gregory, the new chief technical assistant at the electricity works, be increased to £300 per annum at the expiration of six months, if his services are in every way satisfactory.

Glasgow Corporation has increased the salary of Mr. W. Lackie, chief engineer of the Corporation electricity works, from £1,250 to £1,500.

Mr. F. M. Fletcher, A.M.I.E.E., assistant electrical engineer at the Rochdale Corporation electricity works, has been appointed electrical engineer to the Darwen Corporation in succession to the late Mr. Charles Garnett.

Burnley Electricity Committee has recommended that the salary of the electrical engineer, Mr. Starkie, be increased from £500 to £600.

Coventry T.C. has adopted the recommendation of the Salaries Committee to increase the salary of the electrical engineer, Mr. G. Tough, from £900 to £1,050 (see Elec. Rev., November 29th), and has referred back for further consideration the recommendation referring to the salaries of other members of the electrical staff.

Lancaster E.C. has granted a bonus of £100 to Mr. J. B. Patterson for services as acting electrical engineer in the absence of Major G. C. Milnes on service with the R.O. Royal Lancs. Regiment.

Mr. R. L. Acland, electrical engineer and tramway manager at Chesterfield, has accepted an appointment in London, and leaves his present position early in the New Year.

Barnstaple T.C. has increased the salary of Mr. J. W. Hadfield, borough electrical engineer, by £50 a year.

Mr. George Wilkinson, the Harrogate Borough electrical engineer, has received a bronze wreath of oak leaves which some Russian officer prisoners in the German prison at Guadeufrai, Silesia, had made in commemoration of his son, the late Lieut. J. R. Wilkinson, upon whose grave the wreath reposed in the Moravian Cemetery. The wreath has been forwarded through the kindness of the Crown Princess of Sweden, along with a letter of eulogy and sympathy.

For the appointment of tramway general manager at Bury (Lancs.) there were 42 applicants; the following are to be interviewed by the Tramways Committee:—Mr. C. J. Baker, traffic manager, Blackpool; Mr. H. Beeston, chief clerk, Bury; Mr. F. Buckley, general manager, Wigan; and Mr. A. B. Haynes, depôt superintendent, Wigan.

Mr. Wm. Sanderson has relinquished his appointment as electrical engineer to Uphall and Broxburn electricity undertaking, having accepted a similar appointment in Fochabers electricity undertaking. Mr. Alex. Brown has been appointed electrical engineer to the former undertaking.

General.—Mr. S. M. Hills, A.M.I.E.E., has resigned his position in the sales department of the West Ham Corporation electric supply to join the staff of Messrs. Greenly's,

Ltd., specialists in business propaganda. Mr. Hills has had special experience with the publicity side of engineering in the U.S.A., Australia, New Zealand, Japan, Ceylon, and elsewhere which should be of considerable value in planning export campaigns.

Coun. KOSKY has been appointed chairman, and Coun. KEEFE vice-chairman, of the Stepney B.C. Electricity Committee.

Ald. R. A. SMITHSON and Ald. H. BROWN have been appointed chairman and deputy-chairman of the Leeds Tramways Committee, and Mr. H. LUPTON and Mr. J. CLARK chairman and vice-chairman of the Electricity Committee.

Coun. W. A. WADHAM has been appointed chairman of the Barrow T.C. Electricity Committee, and Coun. BARRIE vice-chairman.

Mr. G. H. BROWNE, A.M.I.E.E., has severed his connection with the Mexborough & Swinton Tramways Co.

Roll of Honour.—Sergeant H. BEAUMONT, K.O.R. Lancs. Regiment, who has been killed in action, aged 31, was formerly in the employ of Mr. George Cotton, electrical engineer, of Blackpool, but held an appointment at the Magic City in Paris when war broke out.

Mr. HARRY SHAW, who has died in hospital at Bloemfontein, South Africa, was on the staff of the Blackpool electricity works as mains superintendent.

Corporal A. SHETHER, A.S.C., who has died from wounds sustained last June, was employed by Mr. Philpot, electrical engineer, of Canterbury.

Private C. SMITH, formerly on the staff of the Barnstaple Corporation electricity works, has been killed in action.

Bombardier G. TODD, R.F.A., an apprentice at the Carlisle Corporation electricity works, has been awarded the Military Medal.

Private B. CASTLE, London Regiment, who fell in action, was on the staff of the Telegraph Construction & Maintenance Co., of East Greenwich, S.E.

Private R. BROWNE, who has been killed in action, was formerly employed in the drawing office of the British Thomson Works, at Rugby.

Flight-Sergeant F. R. PEEL, who has died from gunshot wounds in the head, was formerly in the electrical department of Messrs. C. Pratt & Sons, Ltd., aircraft constructors, Bradford.

Lieutenant CYRIL F. BARROW, R.E., has been awarded the Military Cross "for conspicuous gallantry and fine leadership in action." He joined the Motor Machine Gun Corps in December, 1914, and after serving in France received his commission. He was formerly employed in the Bolton Corporation electricity works.

Private H. WOOD, Manchester Regiment, who has been killed in action, was formerly employed at the British Westinghouse Co., Ltd., Trafford Park.

Corporal H. SHAW, Wiltshire Regiment, who has been killed in action, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., cable manufacturers, Manchester.

Captain G. R. D. PRINCE, A.M.I.E.E., who died from pneumonia on November 24th, was formerly with Callender's Cable & Construction Co., at Erith, and joined the staff of Henley's Telegraph Works, at Gravesend; on the outbreak of war he volunteered for foreign service, being gazetted on October 30th, 1914, second-lieutenant in the Kent (Fortress) Royal Engineers (T.). After service in the Isle of Grain and at Sheerness, he served for two and a half years as chief assistant to the Chief Engineer at Chatham, being gazetted captain in 1915, and staff officer. He subsequently transferred to a Field Company, and, after service with the Salonica Force, contracted malaria; while waiting to be transferred home he succumbed to broncho-pneumonia.

Obituary.—MR. H. C. WALKER.—The death has taken place from pneumonia, following influenza, of Mr. Henry Cecil Walker, director of Messrs. Waygood-Otis, Ltd., and eldest son of Mr. H. C. Walker, chairman of the company. Deceased was 41 years of age, and had been associated with the firm for 25 years, being connected with the electrical side of the concern, and was the firm's chief electrical engineer.

MR. A. E. DENMAN.—The death occurred on November 23rd of Mr. Arthur Edward Denman, who was for over 30 years with Messrs. Siemens Bros. & Co., of Woolwich.

NEW COMPANIES REGISTERED.

British Floating Exhibitions, Ltd. (151,993).—Private company. Registered November 21st. Capital, £500 in £1 shares. Exhibitors, agents for manufacturers, charterers of ships for exhibition of goods, furniture dealers, importers, carpet dealers, drapers, ironmongers, earthenware dealers, gas fitters, sanitary and electrical engineers, timber merchants, Manchester warehousemen, paper and paper bag manufacturers, &c. The subscribers (each with one share) are:—F. Sidney, Broad Street House, E.C. 2, solicitor's clerk; Ivy E. Fisher, Broad Street House, E.C. 2, solicitor's clerk. The subscribers are to appoint the directors. Solicitors: W. T. Hick, Broad Street House, E.C. 2.

J. H. Tucker & Co., Ltd. (152,031).—Private company. Registered November 26th. Capital, £150,000 in £1 shares. To take over the business of a manufacturer of electric lighting and power accessories carried on by J. B. Tucker at King's Road, Hay Mills, Birmingham, as J. H. Tucker & Co. The subscribers (each with one share) are:—J. B. Tucker, Lynwood, Ashleigh Road, Solihull, manufacturer; C. F. J. Tranter, 38, Silverbirch Road, Erdington, Birmingham, accountant. First directors: J. B. Tucker (chairman) and C. F. J. Tranter. Solicitor: A. H. Coley, 63, Temple Row, Birmingham.

Logie, Ashmole & Co., Ltd. (152,033).—Private company. Registered November 26th. Capital, £3,000 in £1 shares. To take over the business of a mechanical and electrical engineer, &c., carried on by R. W. Logie as R. W. Logie & Co. at New Street, Burton-on-Trent, also to deal in all goods ordinarily supplied by Sheffield, Coventry, and Birmingham manufacturers and warehousemen, and to carry on business as aeroplane manufacturers, &c. The subscribers (each with one share) are:—R. W. Logie, 132, New Street, Burton-on-Trent, engineer; J. W. Ashmole, 38, Belvedere Road, Burton-on-Trent, electrical engineer. The first directors are: R. W. Logie and J. W. Ashmole. Registered office: 132, New Street, Burton-on-Trent.

James Booker, Ltd. (152,065).—Private company. Registered November 28th. Capital, £1,500 in £1 shares. Factors of jewellery and fancy goods, manufacturers of and dealers in electrical appliances, &c. The subscribers (each with one share) are:—E. Cripwell, 55, Temple Row, Birmingham, solicitor; G. A. Parker, The Chalet, Hall Green, Birmingham, company director. Table "A" mainly applies. Registered office: 27, Hilton Street, Birmingham.

Orbit Electrical Co., Ltd. (152,080).—Private company. Registered November 29th. Capital, £60,000 in £1 shares (30,000 cum. participating pref.). To purchase the business of manufacturers of and traders in electrical batteries, pocket and other flashlamps, and general electrical appliances, fittings, and accessories, carried on at Electric Works, Station Road, Chadwell Heath, Essex. The subscribers (each with one ord. share) are:—H. B. Stocks, 2, Coleman Street, E.C., engineer; R. D. Browne, 2, Coleman Street, E.C., merchant. The first directors are:—H. B. Stocks, R. D. Browne, and T. T. Rankin, B.Sc. (all permanent). Registered office: 2, Coleman Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—Issue on November 19th, 1918, of £2,000 debentures, part of a series already registered.

Electric Supply Co. of Victoria, Ltd. (66,059).—Return dated October 30th, 1918. Capital, £325,000 in £1 shares (175,000 pref. and 150,000 ord.). 175,000 pref. and 125,000 ord. shares taken up; £50,007 paid; £249,993 considered as paid. Mortgages and charges: £134,862.

National Electric Construction Co., Ltd. (53,364).—Return dated June 13th, 1918. Capital, £125,000 in 10s. shares. 170,000 shares taken up; £75,574 10s. paid on 151,149 shares; £9,425 10s. considered as paid on remainder. Mortgages and charges: £75,000.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Return dated October 10th, 1918. Capital, £50,000 in £5 shares. All shares taken up; £50,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Ferranti, Ltd. The net profit on trading for the year to June 30th last was £35,174, after making provision for general establishment charges, bad debts, repairs and renewals, income tax and interest on debenture stock, five-year notes and loans, and making the usual allocation to depreciation reserve, but no provision has been made for excess profits duty, which has not yet been ascertained. The net profit for the previous year was £7,650. The outlook for the company's ordinary manufactures shows signs of improvement, although facilities for export trade are meantime limited. Substantial reductions have been made in the amounts outstanding in respect of debenture stock and loans from bankers, and arrangements made for the renewal of the five-year notes until 1922. The directors recommend payment of a dividend of 6 per cent., less tax, on account of arrears of dividend accrued on preference shares, and hope at the conclusion of the war to bring forward a scheme for the funding of these arrears and to readjust the capital. Annual meeting, December 13th, in London.

Spain.—Our correspondent in Spain sends the following notes on some small Spanish companies.

S.A. El Tibidabo.—This company exploits a tramway on the outskirts of Barcelona, and a funicular railway up Mount Tibidabo, and also owns land and houses in the same district. There is a paid-up capital of £60,000. The directors in their report for 1917 lament the effect that wartime has had upon the business by reducing the number of tourists. The dearness of materials, the increase in running costs, and the August strike of last year also had a bad effect. A net profit of £4,402 is shown, and a dividend of 6 per cent. is recommended, also a payment of £792 to the directors, while £10 goes to the reserve fund.

Co-operativa Eléctrica Bilbao.—This company reports total receipts of £13,531 for energy sold, meter rents, &c., and total expenses £9,202. The profit for the 12 months' working—£4,329—is sufficient to declare a 6 per cent. dividend, free of tax.

Sociedad Eléctrica Santa Teresa, Jabago, province of Huelva.—This company has just held its annual general meeting to consider the 1917-18 report. The undertaking has a capital of £50,000, and supplies electrical energy to about a dozen small towns and villages in the district. It also owns a flour mill (driven by water power), and the report declares that in spite of the impossibility of obtaining cereals at the maximum price decreed by the Government, and in spite of increased costs in all directions, the mill shows a larger income than during the previous year. Receipts for the supply of electrical energy also show an increase of £326 on the preceding year, but this was just balanced by increased costs. This cost increase was owing to the hydro plant being insufficient to carry the load throughout the dry season, and

the steam plant had to be put in service. The company states that the average running cost per H.P.-hour at the steam plant was 1.3 pence, while the maximum at the hydro-electric plant was .2 pence. There is a total income of £7,065, and a dividend of 8 per cent., free of tax, is recommended.

Swiss Companies.—*The Société Franco-Suisse pour l'Industrie Electrique* has just offered for subscription bonds for £240,000. The issue is reported to have been only partly taken up.

The Omnium Electrique, of Geneva, proposes to pay a dividend of 12 per cent. for 1917-18, and a bonus of 12 per cent. out of the reserve funds, these comparing with a rate of 8 per cent. in the previous twelve months.

The accounts of the *Maschinen Fabrik Oerlikon*, which increased the share capital in October, 1917, from £320,000 to £640,000, indicate net profit of £66,000 for 1917-18, as compared with £43,000 in the previous year. The directors recommend a dividend of 7 per cent., in which the new capital will participate to the extent of one half, being the same rate as in each of the two preceding years.

The Watt A.G. fur Elektrische Unternehmungen, of Glarus, which is closely associated with the Zurich Bank for Electrical Undertakings, states that the company's activity in 1917-18 was restricted to investments already in portfolio. The receipts from interest and commissions increased from £14,000 in 1916-17 to £16,000 last year, but after defraying working expenses and taxes the accounts show a loss, and no distribution is possible, as was the case in 1916-17.

Prospectus.—*Siemens Bros. & Co., Ltd.*—The list of applications was to close on or before yesterday (Thursday) in an offer of £500,000 4½ per cent. debenture stock at £87 10s. per cent., and 80,000 shares of £5 each at par. The issue is offered by the British Bank for Foreign Trade, Ltd. In the course of an explanatory letter by Mr. G. Mure Ritchie, the chairman, published with the prospectus, it is stated that Siemens Bros. & Co., Ltd., owns the whole of the share capital and the debenture stock in Siemens Bros. Dynamo Works, Ltd., and the two companies together possess freehold land and buildings at Stafford covering an area of 62 acres, and works at Woolwich covering about 17½ acres, and a factory is rented at Dalston which has been equipped for the manufacture of metallic filament lamps and has a capacity for an annual output of 2,500,000 lamps. In all the chief classes of manufacture the companies are doing an extensive and increasing business.

In addition to their selling departments at Woolwich and London, the companies have established selling branches for their products at Birmingham, Cardiff, Glasgow, Manchester, Newcastle, Sheffield, and Southampton, in Australia at Sydney and Melbourne, in India at Bombay, Calcutta, and Madras, in the Straits Settlements at Singapore, in South Africa at Cape Town, and in Canada; further, they have representatives or correspondents in the chief towns of South America, New Zealand, China, and Japan. They are thus in a position to secure and carry out a fair proportion of the profitable orders for electrical work which it is anticipated will be obtainable from all countries as soon as manufacturers are free from their war contracts.

The assets and the liabilities of the two companies taken from the audited accounts at December 31st, 1917, being the close of the last financial year, and after providing for the reduction of the liability to the Public Trustee and the 4½ per cent. debenture stock now issued to £1,000,000, resulting from the sale of the 80,000 shares and £500,000 4½ per cent. debenture stock, are as follows :—

Assets: Freehold and leasehold properties and works, machinery, tools, s.s. *Faraday*, stock and work in progress, debtors, investments, cash and treasury bills, &c.	£3,227,282
Less Liabilities: 4 per cent. debenture stock, 4½ per cent. debenture stock, creditors, &c.	£1,942,003
Surplus, subject to payment of excess profits duty	£1,285,279

Nothing has been included in the above figures for the valuable goodwill of the business or in respect of the very large number of patents belonging to the companies. The cable steamer *Faraday* was built at a cost of about £150,000, and is classed 100 A1 at Lloyds; her gross tonnage is 5,028; her value is taken in the above figures at £18,000, but at the present time she is insured for £200,000.

The dividends paid by the company in recent years have been 5 per cent. for 1913, 7 per cent. for 1914, 6 per cent. for 1915, 7 per cent. for 1916, 10 per cent., free of income tax for 1917, and an interim dividend at the last-named rate has been declared in respect of the half-year ended June 30th, 1918. The profits of the two companies for the year 1917 before deducting interest on capital debts and debenture stock and provision for excess profits duty, amounted to £338,462. The interest on the 150,000 4 per cent. debenture stock and the interest and redemption fund on the £1,000,000 4½ per cent. debenture stock together will amount to £73,439 per annum.

Whilst going to press we learn that the issue was oversubscribed.

Auckland Electric Tramways Co., Ltd.—The total revenue for the year ended June, 1918, was £301,434. Traffic receipts were £294,564, an increase of £11,866. After providing for expenses chargeable to revenue, including debenture and other interest, also payments to Auckland City Council (£5,431), putting £25,000 to renewals and depreciation, the surplus on working is £53,430, plus £5,292 brought forward. After paying the preference dividend, and putting £10,000 to reserve, a further dividend of 1s. per share (making a total of 1s. 6d.), less tax, is paid on the ordinary shares, leaving £5,972 to carry forward. No capital was issued during the year; the capital expended was £3,944. Passengers carried 44,823,967, against 43,351,032 last year; average receipt per passenger 1.58d., against 1.57d.; average expenditure per passenger 1.04d., against 1.00d.

Fuller Accumulator Co., Ltd.—The report to October 31st, 1918, states that the amount of available profit is ample to pay dividends for the year of 10 per cent. on the preference and 15 per cent. on the ordinary shares of the company, as against 10 per cent. last year, after making liberal allowances for depreciation of buildings, plant, and patents. Further additions have been made to the company's equipment in machinery, plant, buildings, land, &c., and the prospects continue to look most promising.

Napier-Kimber, Ltd.—The annual general meeting was held on November 7th; a dividend of 10 per cent. has been paid on the ordinary shares, free of income tax, and, after making provision for excess profits tax and debenture interest, &c., a balance of £350 is carried forward. During the year the capital of the company has been doubled out of accumulated profits by the issue of one bonus share for every share held.

STOCKS AND SHARES.

TUESDAY EVENING.

FEW fresh features have developed in the Stock Exchange during the past week. Until the New Year, members of the House do not look for anything substantial in the way of business. As the General Election draws nearer, interest drifts more into politics and more away from markets, while the inevitable preparation for window-dressing makes its influence felt even at this distance from December 31st. In no part of the Stock Exchange is there anything like activity.

The Home Railway market was not encouraged by the meeting at the Albert Hall last Sunday. Labour's attitude towards the railways, if it cannot be called hostile, is not calculated to drive money into stocks and shares connected with this industry. The market enjoys occasional slight spurts, but they turn out to be short-lived. The sharp rise in Metropolitans last week has been fairly well held, the reaction being moderate; Districts have shed 10s. Underground Ordinary shares weakened to 3½, but the Income bonds are better at 89½, and London Electric ordinary at 3½ are ¼ up.

It is satisfactory to be able to dwell upon the continued strength of home electricity shares. Nearly all the recent improvements, material as they were, have been maintained. The only decline in the list this week is one of 5s. in City of London ordinary, making the price 13½. London Electrics have risen to 30s. Dealers in the market report that buyers still outnumber the sellers, and that there is not enough stock to go round for those who want to get in at anything like the middle prices. The latest issue of Newcastle Electric Supply ordinary shares keep strong at 2s. 3d. premium above the 10s. 6d. paid on the shares, which were offered, it will be recalled, at 20s. 6d. The fully-paid are quoted 22s. 6d. Notting Hill preference changed hands the other day at 9½ and over, but the ordinary shares have not been dealt in since July, the last-recorded bargain being at 33s. 9d. General and Electric Investment preference are 10s. higher at 2½.

Victoria Falls ordinary shares are a trifle easier at 21s. 6d., in sympathy with the heaviness of South African mining shares, due to the influenza outbreak amongst the natives which has seriously diminished outputs during the past two months. Amongst the manufacturing shares, Cromptons are attracting a little attention in the neighbourhood of 16s., and, on Monday, 18s. 9d. was paid for the preference, 94½ for the 6 per cent. debentures. British Westinghouse preference at 2⅜ are ½ down, although the result of the meeting was regarded as fairly satisfactory. Electric Constructions at 25s. xd show no particular change, allowing for the deduction. General Electric ordinary have eased off to 17½. Brush ordinary stock at 60 shows a gain of 2 points.

Siemens have now issued the prospectus of new shares and debenture stock, and, on the information supplied, the latter looks a good security, while, as regards the shares, these may be considered a fair speculative investment. The price of the existing issue gave way a little to 6 3/16 on the offer of the new capital. One bargain was marked as low as £6 0s. 10½d. Babcock & Wilcox are a feature of strength in their particular department, a rise of 5s. lifting the price to 3½, and the market being still a good one.

Marconis have gone back to 4⅛ after their recent rapid rise, the decline being due to the general conditions prevailing in most markets. With the reaction in the parent shares, the preference have also given way to 3¼, while of the subsidiaries, Americans dropped back to 31s. 3d., and Marines to 3¼, Canadians remaining more or less lifeless in the neighbourhood of 14s. The list of cable stocks as a whole is abnormally quiet. Eastern ordinary has gone back to a shade under 160, so that the return on the money comes to a few pence over the round 5 per cent., the dividend being paid, of course, without deduction of the income-tax. Anglo-American Telegraph deferred stock eased off to 23¼, and the return at the present price is practically 6½ per cent. on the money; rather more, in fact, if allowance is made for the

fact that the full year's dividend is due in February, so that the current price includes some ten months' dividend at the rate of 30s. per annum. Considering the security, and the stock, it looks reasonably cheap. Direct United States shares are also a little easier at 6½.

The foreign list is noticeable for a further rise in British Columbia Electric preference to 67½, although the deferred at 47½ is a point down. The Argentine group is scarcely so good, some little hesitation being introduced by the recent allusions in Argentine railway reports to the question of expense in the Republic. Anglo-Argentine Tramways first preference have lost 1/16 at 4¼, but the second preference are maintained at 3 13/16, the last business being marked in these shares at 3¾ nearly a month ago. Mexican securities hold their prices, and Mexico Trams have risen to 42, although Mexican Light first bonds at 72 are a trifle lower. Rio Tramway bonds are good at 92, and the seconds at 85, while San Paulo firsts went ex dividend on Monday, and are now 90, the 5 per cent. consolidated debenture stock being easier at 79. London United Tramways 4 per cent. debenture stock is marketable at about 42½, and London and Suburban Traction ordinary at 4s. 3d.; the preference, at 9s. 3d., have come in for a little notice during the past few days. British Electric Traction is steady at 48½, and the preference at 78¼ is now ex dividend. A rise of 5 points lifted River Plate Electric ordinary to 160.

In the telegraph manufacturing list, Telegraph Constructions have lost the 10s. which they gained last week, but otherwise there is no alteration. The rubber market is quiet. Armaments have strengthened in sympathy with activity in the explosives group, aroused by publication of the terms of the Combine. The base-metal market is heavy, and post-war problems continue to exercise the minds of those interested in such companies.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 3, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7½	—	£7 0 6
Charing Cross Ordinary	5	4	3¼	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	3¾	—	6 13 4
Chelsea	8	5	3½	—	6 9 0
City of London	8	8	13½	— ½	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	11¼	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
Kensington Ordinary	6	7	5½	—	6 7 3
London Electric	Nil	Nil	1½	+ ¼	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3½	—	6 8 1
do. 4½ per cent. Pref.	4½	4½	3¾	—	6 18 6
St. James' and Pall Mall	8	9	7½	—	6 6 4
South London	5	5	3⅞	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7½	—	6 6 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	29½	— ¼	6 9 0
Chile Telephone	8	8	7⅞	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅞	—	*5 1 7
Eastern Tel. Ord.	8	8	159½	—1	*5 0 5
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	23	33	—	6 13 5
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅝	— ¼	4 6 7
Oriental Telephone Ord.	10	10	3¼	—	2 17 2
United R. Plate Tel.	8	8	7⅛	+ 1/16	*5 4 0
West India and Panama	6d.	1/3	1⅛	—	*3 12 6
Western Telegraph	8	8	16½	—	*4 15 7
Home Rails.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan	—	1	29	— ½	8 9 0
do. District	Nil	Nil	25½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8¾	— ½	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	6	4	80½	+1	*4 9 5
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	42	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	4¼	+ 1/16	—
do. do. 2nd Pref.	5½	—	3⅜	—	—
do. do. 5 Deb.	5	5	76xd	—	6 9 0
Brazil Tractions	—	—	57½	— ½	—
Bombay Electric Pref.	6	6	106	+	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	+1½	7 11 5
do. do. Preferred	Nil	Nil	59½	—	Nil
do. do. Deferred	Nil	Nil	47½	—1	Nil
do. do. Deb.	4½	4½	68	—	6 17 3
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	85	—	Nil
Mexican Light Common	Nil	Nil	40	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	72	—1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	34	— ½	3 17 6
British Aluminium Ord.	10	10	1¾	—	5 14 4
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2¼	— ½	5 14 1
Callenders	20	25	9⅜	—	6 9 10
do. 5 Pref.	5	5	5	—	—
Castner-Kellner	22	20	3⅞	—	5 10 4
Edison-Swan, "A"	—	—	4	—	Nil
do. do. 4 per cent. Deb.	4	4	70½	—	5 6 0
Electric Construction	7½	10	1½xd	—	8 0 0
Gen. Elec. Pref.	6	6	102	—	6 2 4
do. Ord.	10	10	17½	— ½	*5 12 8
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 14 3
Telegraph Con.	20	20	46	— ½	*5 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 4th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	1/8	..
a Ammoniac Sal per ton	£100	..
a Ammonia, Muriate (large crystal) "	£77	..
a Bisulphide of Carbon "	..	..
a Borax "	£43	..
a Copper Sulphate "	£60	..
a Potash, Chlorate per lb.	2/4	..
a " Perchlorate "	2/-	..
a Shellac per cwt.	£17 10/-	..
a Sulphate of Magnesia per ton	£15	..
a Sulphur, Sublimed Flowers "	£94	..
a " Lump "	£96	..
a Soda, Chlorate per lb.	1/1	..
a " Crystals per ton	170/-	..
a Sodium Bichromate, casks per lb.	..	..
METALS, &c.		
c Brass (rolled metal 3" to 12" basis) per lb.	..	..
c " Tubes (solid drawn) "	..	..
c " Wire, basis "	..	..
c Copper Tubes (solid drawn) "	1/8½ to 1/9	..
g " Bars (best selected) per ton	£161	..
g " Sheet "	£161	..
g " Rod "	£161	..
d " (Electrolytic) Bars "	£137	..
d " " Sheets "	£161	..
d " " Wire Rods "	£147	£2 inc.
d " " H.C. Wire per lb.	1/6⅜	..
f Ebonite Rod per ton	8/-	..
f " Sheet "	2/6	..
n German Silver Wire "	2/6	..
h Gutta-percha, fine "	6/10	..
h India-rubber, Para fine "	2/10	..
i Iron Pig (Cleveland warrants) per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. "	£37	..
g Lead, English Pig "	..	..
g Mercury per bot.	Nom.	..
c Mica (in original cases) small per lb.	9d. to 4/6	..
c " " " medium "	5/- to 10/-	..
c " " " large "	12/6 to 25/- & up.	..
d Silicium Bronze Wire per lb.	1/10	..
r Steel, Magnet, in bars per ton	..	..
g Tin, Block (English) "	..	..
n " Wire, Nos. 1 to 16 per lb.	6/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Instruments for Testing Electric Welds Needed.—There is a great and urgent need for a simple workaday instrument or means for properly determining the relative strength or value of an electrically welded joint, according to J. G. Dudley, who is a member of the electric welding committee of the Emergency Fleet Corporation and of its research sub-committee, which is now affiliated with the National Research Council. According to the *Electrical World*, he says: "To those who have gone deeply enough into the question of electric welding such a testing machine would not seem to be vitally necessary, but in the shipbuilding industry all work of any sort must be so done as to pass the approval of the so-called classification societies. Chief among these is the British Lloyds, whose ultra-conservatism is blocking somewhat a wider use of electric welding. The principal reason probably is that its inspectors, in widely separated localities, naturally cannot be all-round technicians, and, lacking some simple means of satisfying themselves that an electrical weld is strong, they take the stand that it is wrong and disapprove it or condemn it. Some of the most eminent specialists and the best laboratories in the country have been attacking this problem for many months, but they have not yet solved it." It is suggested that those who have ideas on the subject communicate directly with Mr. Dudley, in care of Chester Shipbuilding Co., Finance Building, Philadelphia, Pa.

The Commercial Value of Exhaust Steam.—In *Power*, of October 22nd, an abstract is printed of Mr. F. C. Ruck's paper on this subject, which was read before the National Association of Stationary Engineers at Cincinnati on September 12th. The operating-cost data from a 250-H.P. isolated plant are given, showing the importance of utilising exhaust steam and the need of such economy. It is stated that a saving in fuel of 10 per cent. to-day is equal in money to that of 20 per cent. two years ago. There is hardly an establishment to-day where steam power is used, where some exhaust steam is not required for heating or drying or for heating water. In such concerns there is no excuse for using live steam at low pressure when exhaust steam is available.

REVIEWS.

Telegraphy, Aeronautics and War. By Charles Bright, F.R.S.E., M.Inst.C.E., &c. Pp. 384, with Appendix and Map. 1918. London: Constable & Co., Ltd.

You might put it either way: "A Board of Imperial Communications" or "An Imperial Board of Communications." But whichever way you put it, or whatever you call it, the need for such a board is the main argument of Mr. Bright's latest book.

The book is not the happiest piece of book-making we have encountered, because it is made up of addresses on the same subject, or set of subjects, delivered at different places and times, so there is an amount of repetition which at times becomes irksome. Also, Mr. Bright carries the foot-note habit almost to the point of a vice; nearly every page has its string of foot-notes, with the result that the symmetry of the printed page is constantly marred, and the sequence of the argument frequently interrupted. The book is well printed and bound, and has a good index. This being said, and these small criticisms are made in the ordinary course of the reviewer's duty, purely from the literary point of view, let us go on to say that with Mr. Bright's main argument—the need for an Imperial Board of Communications—we are in hearty accord. In fact we would like Mr. Bright to produce a book—condensed to about a third of the present volume, with foot-notes rigidly barred, and such side issues as aeronautics and war treated as part of the general subject—exclusively devoted to developing the argument for an Imperial Board of Communications.

The I.B.C., to adopt the official slang of the day, would deal with the study and development of means of rapid communication throughout the Empire. The I.B.C. would be a sort of Imperial General Staff, devoted not to the study of war, but to the study of peace and the development of civilisation and commerce through the perfection and security of communications. It is a very fascinating subject. Undoubtedly highly organised and efficient means of communication are one of the greatest needs as well as one of the most striking attributes of civilisation. Even the most superficial traveller judges the stage of development a country has reached more or less by the efficiency of its communications. If the roads are bad, the railways slow and unpunctual, the post infrequent, telegrams long delayed and inaccurate, the telephone sparse and exasperating—then the state of civilisation is obviously indifferent. Big industrial communities like the United States and Great Britain need highly efficient communications, and, in the main, have them, though each country has a certain amount of leeway to make up in some directions—the United States in roads, and Great Britain in telegraph and telephone systems and in electric railways.

But if great countries need efficient communications, how much more does a great Empire need them, to bind together its many parts strung all round both hemispheres, and scattered from pole to pole? This is Mr. Bright's main theme—Imperial communications occupy three-quarters of the book, and in Imperial telegraphy, cable, and wireless, he is well versed, having had many opportunities of gaining first-hand knowledge, and having been an untiring student of the subject for many years.

The book will interest all those who are concerned in telegraph engineering and in the development of electrical communications, and it should interest also those who have at heart the sound development of the British Empire, which may be so much aided and vitalised by efficient communications. It should also interest statesmen and military men who appreciate the strategic importance of communications, a branch of the subject on which Mr. Bright wrote a good deal before the war. The high importance of communications has been exemplified to such an extent during these four hard years, that it seems almost inconceivable that when peace returns no concerted and persistent effort shall be made to put Imperial communications on sound lines of development, thought out in a truly Imperial way.

The telegraph part of Mr. Bright's book is interesting and contains many suggestions tending to improved methods and more broad-minded organisation. The aeronautical part, and the section devoted to a collection of addresses on the general subject of the war, are a little out of date. Mr. Bright served on the committee which inquired into the organisation of the Royal Flying Corps in 1916, and made many useful suggestions in a special report; in fact Mr. Bright seems to have been one of the hardest-working members of the committee. The development of the Flying Corps, now merged into the Royal Air Force, has been so prodigious during the past two years, and the art of flying has reached such heights and intricacies that this part of the book has now merely an historical interest.

As an engineer and traveller, a stout Englishman, and a student of politics, Mr. Bright had naturally much of interest to say to his fellow villagers when he addressed them on the subject of the war in general. This part of the book is outside the scope of a technical journal, but we cannot forbear from quoting one short passage, because it expresses the views of the great majority of practical men, as follows:—

"The experts have been to a great extent subservient to the will of the inexpert politician, which has, amongst other things, introduced serious delays at vital moments. To faulty organisation—or to lack of organisation—by the politicians must be laid the responsibility for a far greater loss of life and treasure than need have been or ought to have been."

Handbook of Mechanical and Electrical Cost Data. By H. P. Gillette and R. T. Dana. London: Hill Publishing Co., Ltd. Pp. xviii. + 1,734. Price $6.

This remarkable work, forming the latest of a long series of similar handbooks associated with the names of the authors, should fill an important place amongst the engineer's works of reference. The authors claim, we believe with justice, that it is the sole representative of its class in the particular field concerned; and for a first edition it covers an astonishingly wide range, containing a vast amount of detailed information. It is intended to be a companion volume to two others by the same authors acting separately, dealing respectively with costs of engineering works and costs of construction plant. The present volume commences with a valuable chapter on general economic principles, followed by one on depreciation, repairs, and renewals. The remainder of the book is devoted to the detailed costs of buildings, moving and installing machinery, coal handling, power generation by steam, gas, and hydroelectric plant, initial and operating costs of electrical installations, overhead and underground mains, lamps, motive power, pumping, cranes and conveyors, electric railways, &c. All these subjects are dealt with in great detail, the data being derived from actual practice; the particulars given are by no means confined to costs—on the contrary, a very large proportion of the matter consists of mechanical or electrical data which, indeed, are helpful in determining costs, but have only an indirect bearing on that factor. The book is freely illustrated, mainly with curve diagrams, but many of the figures serve to show the precise character of the buildings and installations of which particulars are given in the text; for instance, one vertical and five horizontal sections of a 220-ft. reinforced-concrete chimney are given, with details of the cornice and base, and similar details of a steel chimney 400 ft. high are provided, together with an account of the method of erection of a smaller one. No fewer than 20 curve diagrams are given for the cost of steam power under a variety of working conditions. In connection with electrical transmission an interesting point is brought out in the application of Kelvin's law, which neglects the fact that the sale price of energy may be many times the cost of generation; hence a greater outlay on copper than is indicated by that law is usually justified. The book is a mine of information as regards not only engineering practice, but also the principles involved, and to those engaged in the design, lay-out, and installation of plant, tramways, &c., it should prove of invaluable assistance.

ELECTRIC WELDING.*

By H. A. Hornor.

The Electric Welding Committee of the Emergency Fleet Corporation of the U.S. Shipping Board is composed of representatives covering broadly the whole field of welding activities in America, and, although electric welding has been the subject of all the investigations up to the present time, it is now proposed to include gas welding, with representatives from all the gas-welding associations and companies connected with this industry.

Fig. 1.

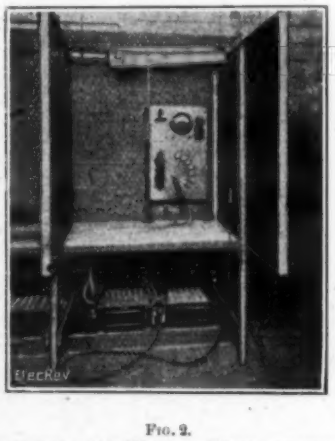

Fig. 2.

Fig. 1.—Partially Completed Arc-Welded Seam, showing Tack Welds.

Fig. 2.—Welding Booth.

A very comprehensive set of symbols has been approved by the Committee, and is in daily use.† The approved nomencla-

Proceedings, A.I.E.E., Vol. 37, No. 10, October, 1918. Abstract.

†Elec. Rev., p. 352, October 11th, 1918.

ture introduces the subject to the designing and calculating engineer, and gives him the instrument by means of which he is able to place his thoughts rapidly and conveniently on drawings.

The manufacturers of apparatus joined the practical man in the study of the problems of electric welding. The manufacturer, in his eagerness to meet the problem, naturally encountered many difficulties. These difficulties increased until a point was reached where he demanded some standards upon which his apparatus could clearly be rated. Therefore the manufacturer was only too pleased to co-operate with the Welding Committee, and is to-day conscientiously aiding in straightening out the difficulties in which he was involved prior to last year.

Fig. 3.

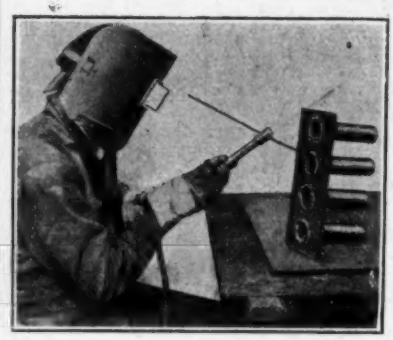

Fig. 4.

Fig. 3.—Arc Welding in Flat, Vertical, and Overhead Positions.
Fig. 4.—Arc Welding Boiler Flues.

Arc welding in America has largely been done in the railroad repair shops. It was discovered that the process was much cheaper, and could be performed more rapidly than by any of the gas welding methods. It also could be applied without preheating, and in many cases without the expense of dis-assembling complicated pieces of machinery. Spot welding, besides being used in many different industries, was sought for by the railroad man, and there has been built a gondola car, which has seen some seven or eight years' service. It is interesting to note here the difference in practice between Great Britain and the United States. The former, knowing little or nothing about spot welding, had the practice and application of arc welding very well under way; the latter exactly the reverse.

Apparently the attempts to train operators were rather crude, and it was early observed that the reliability of the electric weld depended substantially upon the skill of the welder. There existed in this respect a great deal of groping in the dark.

Investigations were immediately undertaken to answer the question whether spot welding could be successfully accomplished using 1-in. thick steel plates. Experimental results showed that no difficulty was encountered with ¾-in. and ¾-in. plates. The same remark applies to 1-in. steel plates. In fact, the experimental machine was successful in welding three thicknesses of 1-in. plate, a condition which far exceeds the requirements of merchant ship construction. The practical application of a large 5-ft. gap spot welder will be made at a demonstration of a 40-ft. section of a standard 9,600-ton ship to be built at the plant of the Federal Shipbuilding Co., Kearney, N.J. This is the largest portable spot welder ever built. The consensus of opinion is that the large stationary spot welder of 5- or 6-ft. gap will undoubtedly increase the speed of fabricating sections of standard steel vessels.

The first stage of this investigational work is now almost completed. Sample welds of ¼-in. ship-structural steel were taken by a special sub-committee to 14 different places where electric welding was being performed. This sub-committee saw the welding done, noted the conditions of current, voltage, electrodes, operators, &c., and then prepared the welded samples for tests. The samples were forwarded to the Bureau of Standards in Washington, so that the tests should be conducted by parties absolutely disinterested and without knowledge of how the samples were obtained. The results of these tests showed a remarkable similarity, especially when it is realised that they were made by several firms with different electrode materials, and under varying conditions of the electrical circuit. Practically all of the welds pulled at over 50,000 lb. per sq. in., and several at over 60,000 lb., the average being about 58,000 lb. On the bending test one of the samples was bent to an angle of 78 deg. before a crack started, and final failure occurred at 80 deg. In another case the sample was bent to 65 deg. before the crack started, and final failure did not occur until 86 deg. The point of importance here is that all the welds showed a reliability and satisfactoriness which makes conclusive the opinion that electric-arc welding is applicable for the joining of steel where the structure is submitted to live loads, bending strains, static pressure, or the like. The Sub-Committee on Research is pursuing this subject, and practical samples are being prepared for similar tests using ¾- and 1-in. stock material. It is also preparing various types of joints in heavy plating. A number of other large-size practical tests are being carried out at the present time.

There has been a large increase in output of apparatus, and it may be unhesitatingly stated that there are no difficulties in the way of obtaining all the electrical welding apparatus that is needed. Certain manufacturers who were decidedly of the opinion that direct-current was the only proper current to use for arc welding have within a very recent period changed their point of view, and are willing to admit that alternating current may have certain advantages.

The practice in America in manufacturing establishments of any size has been toward an increase in the supply voltage, so that very few large manufacturing plants use less than 220 volts direct current. With this voltage the only economical method of transformation is in the use of a motor-generator set. The efficiency in this case is in the neighbourhood of 50 to 60 per cent. It is possible to use a supply voltage of 110 volts with a variable resistance, which cuts down the voltage to the arc volts. This gives a very poor efficiency. In the case of alternating current the supply voltage can be reduced by a transformer, which will supply, as in the case of direct current, a sufficient voltage for striking the arc and a satisfactory reduction when the arc has been struck. On the other hand, if a low-voltage alternating current is provided a simple reactance may be introduced which has some of the same wasteful characteristics of the resistance used with the direct current. The average apparatus will permit of electric-arc welding consuming about 6 to 8 kw. per welder, but if low voltage is provided there are certain outfits which will reduce the consumption as low as 3.5 kw. per welder, or even less.

Fig. 5.

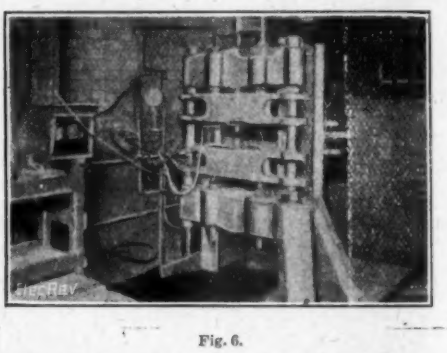

Fig. 6.

Fig. 5.—Section of a Smoke Stack. Seams Arc-Welded. Metal, ¼-in. Boiler Plate.
Fig. 6.—Experimental Heavy-Steel Welding Machine. Current, 100,000 amps.; Pressure, 36 tons.

Without entering into an elaborate analysis of the relative costs of electric welding, it may be broadly stated that there is hardly any question that the electric process is cheaper than any other. The same may be said as regards speed, and also reduction of man-power. In a recent discussion on this subject President Adams stated that at one of the Eastern shipyards the total number of parts on the welding programme of the standard riveted ships now building at that yard amounted to 225,000. The labour cost for riveting those pieces was about 245,000 dollars, and for welding about 99,000 dollars, making a saving of 146,000 dollars. But this is only a drop in the bucket when compared to what might be profitably done in this line. He stated, further, that in certain particular instances the saving was as great as 90 per cent.

One of the interesting questions discussed with some fervour by the members of the Welding Committee is the advan-

tages of the bare and covered electrode.' Regarding this discussion no definite facts can be stated. In England the practice has been to use the covered electrode; the practice in the United States up to the present time has been largely bare wire. Recently, American investigators have discovered that there are advantages in the covered electrode, and many experiments are now being made, some with results. It is important to observe that in the above-mentioned tests of welds, the best one of these samples was made with a coated (not an asbestos covered) electrode using alternating current. The point in this case seems to rest upon the question of the ductility of the weld, and it would seem that the bare electrode does not make as ductile a weld, or at least one as easily bent, as the coated or covered electrode. The question of the ductility of the weld is one of much importance in the application of welding to ship construction, and will doubtless be of importance in other allied industries.

No matter what the type of electrode, its composition, the kind of shank material to be welded, or the kind of apparatus employed, the reliability of the weld rests mainly upon the man who makes it. The work of training electric welding operators early became a part of the functions of the education and training section of the Emergency Fleet Corporation; the men connected with this work are members of the Welding Committee. The objects held in view by the training department are first to give the man intensive practice work so that he becomes a good craftsman. The methods are simple to start with, as the exercise of the right arm muscles must become flexible enough to permit the operator to give the required movement to the electrode. By a graduated series of exercises this is accomplished in about eight weeks. The man is allowed to do production jobs in the shop, which gives him confidence through responsibility. It becomes desirable at this time to give the man some outside work on ships, and where this is practicable it is done. The man is then turned over to an instructor, who gives him an intensive course in pedagogics lasting from five to six weeks. At first sight it would not seem necessary to so instruct a man, but it is not generally understood that teaching after all is itself a trade. The experience with the men in this respect is most interesting. In nearly every case the man has resented this course at the start, but at the end has turned completely around, and in many cases has desired an even more extensive training. What is really accomplished is to give the man the necessary confidence to impart the knowledge that he has gained to another green man. The men under training are taken from the various industries, especially the shipbuilding industry, and are certificated when they have shown themselves to be entirely proficient. The operator must be a conscientious workman or the weld will not be of perfect quality. This brings forward another problem, namely, a practical and scientific method of testing a welded joint after it has been made. There have been a number of suggestions made for the solution of this problem. But at the present time none of these suggested methods have been productive of conclusive results, and recourse must be had to the purely mechanical methods of striking heavy blows on, or adjacent to, the weld, or using a chipping hammer and making intermittent examinations. It would seem by far the best procedure to make the inspector proficient in the art, so that he may closely observe the welders while at work.

The Committee early discovered that the literature of electric welding was very much clouded by mis-statement of fact or half-baked theory, and much of the time of the Committee has been taken up in disproving such statements. In order to spread the results of this work over all quarters a handbook is now being prepared which will contain only definite facts and results of investigations as approved by the whole Committee. This handbook will be made available to all those who desire to acquaint themselves with the proper means of accomplishing good and reliable electric welding.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Mr. A. P. M. Fleming, Chairman of the North-Western Centre of the Institution of Electrical Engineers, delivered his inaugural address on Tuesday, November 12th, at the Engineers' Club, Manchester. Choosing for his subject "The human factor in industry," he remarked that the vital interests of all people were bound up with industry, and the future of the electrical industry would be one of accelerated progress of admittedly national importance.

Post-war industrial policy must be characterised by that boldness, freedom, and breadth of outlook to which war had accustomed us, and many war-time expedients would require to be continued in the even more exacting times of peace.

Many problems in industry were now receiving attention, and those of fundamental importance must be solved, if industry was to be built up on a lasting basis, in the light of fundamental principles. The most important problem in industry concerned the human element in it, and since all changes in industrial life were followed by a mental reaction in the mind of the worker, it was essential that possible changes should be arranged so that this reaction would be as favourable as possible.

Fatigue was one of the greatest difficulties with which the industrial worker had to contend, and to minimise excessive fatigue rest periods were required during the day, and all overtime and Sunday labour should be made unnecessary. Elimination of fatigue would result in decreased accidents. Much fatigue sustained in industry was unnecessary, and could be removed by carefully studying each job, simplifying some movements and cutting out others. Much strain could be avoided by good working conditions, heating, lighting, ventilation, and sanitation, by providing medical attention, canteens, &c. The development of works committees would preclude any criticism of welfare work. Extravagance in welfare work and violation of the privacy of home life should be avoided.

Much could be done to make the worker contented by carefully selecting him for the work he was to do, so as to get the "round peg in the round hole." Education should be such as to allow young people to realise the direction in which their special abilities lay, and, when the individual had taken up the work for which he was inherently fitted, he should have every opportunity of rising to the highest position which inherent capacity justified.

For special war services, psychological methods of selecting men had been employed. In the American Army, recruits had been classified after examination as inferior, normal, and superior mental types. The first and last were further specially examined with a view either to rejection or to employment in special capacities. In this country and in France interesting methods of selecting aviators had been devised, in addition to men for gunnery, signalling, &c.

In all grades of industrial employment selection should be followed by appropriate training. In the case of apprentices this might be done in a works school and in the shops. Teaching of economic principles, in addition to ordinary subjects, was advocated as enabling workers to understand the facts about the industrial system. Special attention was required in the training of managers, and at the University of Manchester a new Directorship of Industrial Administration had been established by a few leading business firms and the university to provide university courses in management.

The most important requirement in industrial life was co-operation between management and workers, and in order to secure this it was necessary to secure the confidence and trust of the human element. History showed that, whenever the human factor had been ignored or opposed, strife and dissatisfaction had resulted, and all difficulties in industry could be removed without sacrificing any valuable features of the existing system. The provisions of the Whitley Report provided a means whereby the legitimate desire of the worker to know more about the inner working of his industry might be gratified.

The lines of advance in the future would include the maintenance of high standards of health and home life for all workers and of good housing, so that character could be developed in children. The need for co-operation could be instilled in the schools, and proper training would be given to all grades of workers. There would be a free upward channel of promotion for all workers with the necessary ability. Managers would take the human element into account and have experts who would study it to guide them.

In conclusion, industry required a new spirit, a spirit of patriotism, and a realisation that it was, as the war had shown, a high form of national service. The material and ethical aspects of industry were interdependent, and the material aspect was not an end in itself, but only a means to an end which concerned the higher purposes of human life. The new industrial ideal would include loyalty and citizenship, it would promote a love of art and science and culture. The future of social reconstruction lay in industry rather than politics.

All members of the community were dependent on industrial processes, and all were therefore concerned in and responsible for industrial progress. It would be impossible to reconstruct in future without making use of the experience and knowledge and changed attitude of mind which the war had brought. We had all suffered the same menace, had shared common hopes and fears, been stirred by common sentiments, and the time had never been as appropriate for embarking on a new enterprise demanding united purpose and mutual co-operation. The principles outlined in his paper suggested that in the industrial sphere, that which was ethically right was economically desirable, and if they could seize the opportunity now presented to apply the principles, a measure of life and well being would be assured to the community which it had never previously known.

Ald. Walker, moving a vote of thanks to the Chairman, said that last session Mr. Fleming outlined a method of education for the engineer. That evening they had heard how the material produced under such a system of education could be best utilised within the works. It was clear, however, that those who went through that course of education would not be content simply to obey orders or instructions without asking the why and the wherefore. It was imperative that employés should be given that amount of knowledge which would make their operations interesting to them. He could conceive nothing more monotonous and more destructive of the human faculty than to be looked upon in the works as merely a part of the machine. There was no doubt that unless there was development along the lines indicated by Mr. Fleming there would be industrial

unrest in this country, and it behoved those who were anxious for the national prosperity to give heed to the warning conveyed in the Chairman's address. He favoured the formation of works' committees on the ground that they enabled the workman to form some idea of the difficulties which his superiors had to face. In the past the workers had only had opportunities of discussing among themselves their supposed and real grievances, and had never been able to understand their true bearing relative to the organisation itself. By means of these committees, however, they would be brought face to face with those difficulties and problems, which they would find not so easy of solution as they thought.

Prof. Marchant, seconding, remarked that the importance to be attached to the human element in industry could not be over-estimated. In the past great attention had been paid to the efficiency of machinery, and far too little to the subtle mechanism which controlled it. In our technical education too much stress had been laid on the technical side of the training to the neglect of the human element, which, to his mind, had been the salvation of this country. He agreed with the views expressed by Mr. Fleming.

Mr. J. F. Nielson opened the session of the Scottish Centre of the I.E.E. at Glasgow on November 12th with his inaugural address as chairman to a large attendance, and gave a general survey of the Institution's activities during the last session, the growth in the application of electric power in shipyards during the last 30 years, and recent applications of electrical science to the equipment, navigation, and propulsion of ships.

On the first point Mr. Nielson said it was unfortunate, but nevertheless true, that this war had undoubtedly helped to bring home to the non-engineering populace the widespread power of the engineer. It had done more than years of peace could have done towards improving the engineer's status. But there remained much still to be done by propaganda and education on right scientific lines to raise the average intellectual level of the people of this country above its present low state. Engineers were partly to blame for that state of affairs; they had been guilty of hiding their light under a bushel, and the country was unfortunately reaping the consequences thereof, to-day in the lamentable spectacle of the waste in men, money, and material through disregard, by those responsible for the conduct of the war, of the technical qualifications of much of the trained intellect of this country.

After a reference to the influence of the Institution on Government opinion in relation to questions of national importance, Mr. Nielson proceeded to a consideration of the growth in the application of electric power to shipyards during the last 30 years. He pointed out that 30 years ago electricity was generated almost, if not entirely, for lighting of workshops, wharves, and ships under construction, and even then only on a small scale. To-day the position was entirely different. The demand for power was in the neighbourhood of 90 per cent. of the total consumption of electrical energy for all purposes in shipyards, and tended to increase, while the lighting load continued relatively to diminish with the introduction of improved and more efficient sources of light. In the case of a certain shipyard, 25 years ago the total number of motors installed was fifteen, with an aggregate horse-power amounting to 40. To-day there were over 600 motors, aggregating not far short of 15,000 B.H.P. The largest motor which that particular shipyard then possessed was one of 8 B.H.P.; to-day motors of 600 B.H.P. would soon be in operation. Last year over 13 million units of electricity were consumed for all purposes. The steam engine had almost entirely disappeared. It was perhaps in the matter of lifting machinery that the greatest improvements, both in increased facilities for operation and in the speeding up of the transport of material, had taken place during the period under review.

A striking feature was the increasingly large proportion of the total demand for electric power taken by air compressors. The uses to which compressed air was being put at the present time in our shipyards, and the rate at which the demand was increasing, must, if he was not much mistaken, be giving municipal and other authorities cause for serious consideration. It had come to his knowledge that during the last few months, orders had been placed in this country for not less than 95,000 H.P. in motors for driving air compressors alone. He would like to think that the efforts which those in authority were exerting to foster the use of compressed air were in every case justified. Whether they were, or not, the power producers would at least benefit thereby, for there could hardly be any form of mechanical power so open to abuse and so liable to be wasted as compressed air, at least in a shipyard. Compressed air was so convenient that unless a very careful supervision was kept over its distribution and utilisation, losses by leakages and abuses might easily become a very heavy item in the power bill under that particular heading. At least that had been his experience, and he supposed most shipbuilders would agree with him.

The application of electric welding to ship construction and repair was being widely discussed in shipbuilding circles at the present time. Of course, as had been, and always would continue to be, the case, enthusiasts would be found whose zeal overran their knowledge, prophesying the almost immediate advent of the shipbuilder's millennium—the dawn of the day of rivetless ships. Progress in the application of electric welding to the jointing of steel structural work had undoubtedly been rapid since the outbreak of the war, but while there were now in service some small barges in which riveted joints were entirely or almost entirely absent, yet it seemed very improbable that the present methods of riveting and caulking would be immediately superseded by any other method. Enthusiastic advocates of electric welding ought to be content with the progress that was being made in applying it at present as an adjunct to the work of the riveter, allowing such a period of time to elapse as might be sufficient to demonstrate whether the electric weld was capable of withstanding, equally with the riveted joint, all the stresses to which those portions of a ship's structure, upon which its safety and the lives of its crew depended, were subjected. At the present moment, expert opinion, strengthened by such practical experience as it had been possible to obtain, was apparently against putting the new on an equal footing with the old method. The operators engaged on that work must be specially trained men, experienced and efficient in the use of the system employed, and they must have efficient supervisors of proved ability set over them. All means of welding were alike in the respect that the quality of the work done was not apparent to the eye, and time alone would tell whether the job was well and efficiently done. An imperfectly executed joint in the structure of a ship's hull might spell disaster to the life of the passengers and crew.

Electric-arc welding as an adjunct to the riveting of water and oil-tight work appeared to have great possibilities, and great economies could be effected in the amount of riveting required for that class of work, if electric welding was used to close the seams and otherwise displace hand or machine caulking. From the point of view of the practical shipbuilder, welding by the electric-arc process on board ships under construction presented a problem which did not appear to have been sufficiently realised by those who advocated its universal application. He referred to the difficulty of screening off from accidental view the hundreds of other tradesmen engaged on other work on board ship. In a confined and crowded space, the risk run of eye injury by such men would be practically unavoidable. Electrical engineers were naturally more interested in the supply of power and the necessary transforming plant required for that work than in the actual details of welding. In that connection there was room for careful and independent investigation to determine the most suitable system and pressure of supply for electric welding. Considerable diversity of opinion existed at present on that subject, more particularly with regard to the pressure necessary to maintain the arc and to overcome the resistance of the insulating flux covering the electrodes. When one manufacturer contended that while 30 to 40 volts were taken up in the arc, 90 to 110 volts must be supplied to enable that arc to be properly maintained, another manufacturer was equally emphatic that that extra pressure represented so much needlessly wasted energy. There was considerable scope for independent research, which might very well be undertaken by the Research Committee of the Institution.

Dealing with electric propulsion of ships, Mr. Nielson said that while electric propulsion had its beginning in this country, we had allowed its development to be carried on by others. In particular, America had tackled that problem in no half-hearted fashion, and already there were thousands of electrical horse-power in turbo-generators, either installed or being built for installation on board ships of the U.S. Navy. He had been unable to ascertain what was the actual number of electrically-propelled ships, built or about to be built, on the other side of the Atlantic. There were at least two merchant steamers of 12,500 tons displacement now under construction in the United States, each of which was to be electrically propelled by two motors of 1,500 H.P. That was, of course, quite a small proposition in comparison with what the American naval authorities had in hand, and it was very significant of the confidence which our American friends, rightly or wrongly, placed in that means of marine propulsion, that one electrical manufacturing firm alone had on order complete equipments for turbo-electric propulsion for no less than seven battleships and four battle-cruisers of an aggregate shaft horse-power not far short of one million. The battleships were of 37,000 S.H.P., 32,000 tons displacement, and 22½ knots speed; while the battle-cruisers were of 180,000 S.H.P., 40,000 tons displacement, and 34 knots speed on trial. Both the battleships and the battle-cruisers were designed to have four propelling motors, each motor being in a separate compartment, but while the power units in the former were two in number, four turbo-alternators were to be provided in the latter.

In the event of electric propulsion making headway, three-phase alternating current was certain to follow as a general system of distribution for auxiliary power and lighting, and where large motors were required to operate such auxiliary machinery as capstans, winches, steering gears, and similar reversible machinery, the electro-hydraulic system of power transmission in combination with squirrel-cage induction motors would form an ideal arrangement. For forced draught boiler-room fans, where a direct-coupled, adjustable-speed motor was required, direct-current motors would probably still be found the most suitable type. The future held out great possibilities for an ever increasing usefulness for electric power on board ships.

SCIENCE AND THE FUTURE.

At the opening meeting of the session of the Royal Society of Arts the Chairman of the Council, Mr. A. A. Campbell Swinton, F.R.S., delivered an interesting address, from which we make the following extracts.

In the future, if the industries of this country are to flourish in the face of the world's competition, it is above all things necessary that science should play a greater part in them that it has done in the past. In arriving at the conditions that are desirable, manufacturers will require all the help they can get, and especially they should be able to look for assistance from the Government of the country. Much in this direction is already under way. Whatever sums, however large, the Government can be induced to spend in promoting the applications of science to industry, provided the expenditure is wisely directed, will quickly repay themselves many times over by the increase of prosperity that they are certain to bring about. At the same time, let us beware of Government control, which in the long run is almost sure to result in political interference, and consequent disaster. All experience goes to prove this, and not least the experience that has been gained during the past four years of war. Signs are now not wanting that at length the claims of science in education are beginning to be recognised.

There is one method of acquiring a scientific education to which, in my opinion, not nearly enough attention is paid. I refer to the private reading of technical books and of periodic scientific literature. In the past many of our leading scientific men have owed their education almost entirely to this method. It is not within the power of many young men to buy books to any great extent, and scientific literature is not only expensive but is notoriously ephemeral, becoming rapidly obsolete and comparatively valueless. Most of the large scientific libraries such as are possessed by the various engineering institutions and other scientific societies are only accessible to their members, and even then only during hours which to a large extent preclude their use by those who have to earn their livelihood. Whenever possible these libraries should be kept open on Saturday afternoons and in the evenings. Members of some of our leading engineering institutions complain that their libraries are useless to them, as they are only open at hours when they are perforce otherwise engaged. I am sure that some improvement is possible in this respect; but what I am anxious particularly to put forward is the desirability of the establishment of lending libraries from which all the latest scientific works could be obtained under suitable arrangements. The Institution of Electrical Engineers has of recent years instituted such a lending scientific library, but only to its own members and on a comparatively small scale; but, of course, to be of any wide use such an arrangement must be on a large scale and throughout the country. It is suggested that something more in this direction might be done by the Patent Office, which has large funds available entirely derived from the fees paid to it by inventors. It is impossible also to exaggerate the utility of public or semi-public lectures on scientific and technical subjects in spreading knowledge in these subjects and stimulating curiosity, thought, and invention. It is by such popular lectures that general interest in science can be roused, rather than by more strictly scientific dissertations.

There have been those who have thought that scientific discovery would before long come to a stop owing to the dearth of subject-matter and to the limitations of the human intellect. Nothing could be more erroneous than this idea, for the reason that every new discovery and invention opens up the path for others, and thus the scientific horizon surely widens year by year. So far from discovery and invention being likely to come to a stop, both are sure to extend at a rapidly increasing rate, particularly if we have more science taught to young people and greater encouragement given to scientific workers, with consequent additions to their numbers. In the comparatively new fields of radio-activity, electromagnetic radiation, synthetic chemistry, chemical catalysis, electrical osmosis, photo-electricity, and corpuscular matter, to mention at random only a few, the prospect seems practically illimitable. Moreover, new materials with new properties afford fresh means for pursuing research. We have also new mechanical appliances of all sorts, and new methods which enable us to obtain on the one hand, in the electric furnace, temperatures approaching in heat to that of the sun, and on the other hand, in special refrigerators to cold quite near to that of space and of the absolute zero—temperatures both high and low, quite beyond reach only a few years ago. Again, we have learnt how to apply prodigious mechanical pressures and how to obtain gaseous vacua on unprecedented scales. We can produce and employ electric currents and pressures, and both electric and magnetic fields, of intensities previously unknown, and measurements of all kinds can be made with a delicacy and an accuracy almost beyond belief. If we turn from pure science and its possibilities to inventions and the science that is applied to utilitarian uses, here again the effects are cumulative, both discovery and invention assisting to bring still further invention within our reach.

During the past five years the improvements made in wireless telegraphy and telephony have been very important, but as yet it is not admissible to discuss them. One matter, however, within public knowledge is the increasing amount of news that we get in the papers that appears under the heading of "Per Wireless Press." Wireless telegraphy appears to be developing at last in what has always appeared to me to be its proper field, which is not so much to communicate between one individual and another, but rather for the communication of intelligence broadcast over the earth. Printing telegraph instruments operated by wire, that record sporting, parliamentary and general news, have long been familiar objects in clubs and hotels; there is no reason at all why similar printing instruments should not be operated by wireless means, not only in large cities, but throughout the country. Special transmitting stations using different wave-lengths could send out the messages, while separate printing machines, tuned each to respond to the wave-length of a particular transmitter, at each required point, would receive and record them.

For the distribution of news to the Press nothing could be better or more economical, while there is no reason why clubs, hotels and private houses everywhere should not also be thus supplied with the latest intelligence. In wireless telegraphy it costs no more to send signals to a thousand receiving stations than to a single one, and there is practically no limit to the number of the stations that can simultaneously receive signals from a single transmitting station. At any rate as concerns an area no larger than Western Europe and the British Islands, it is well within the range of practicability at the present time.

Great things are at present being foretold as to the marvels that we are to see in the way of the electric distribution of energy throughout the whole country from a small number of giant generating stations. Great improvement over our present parochial methods is no doubt possible, but let us not be too sanguine. Some of the most experienced authorities are of the opinion that the limits of economical generation and distribution are already being reached in the case of some of our larger systems, and that when we get above tens of thousands of horse-power, the step to hundreds of thousands does not effect more than a small percentage of saving, either in first cost, or in cost of working.

No one knows what improvement is yet to be obtained in the conductivity of metals by further purification, and especially by freeing them entirely from occluded gases. Electrolytic copper, which is specially pure, has already a conductivity measurably in excess of what was obtainable by the older methods of refining, while it has been found that in the case of palladium the extraction of the occluded hydrogen materially improves the conductivity. Possibly similar treatment might lead to important results with other metals. The subject is still largely unexplored, but if any practical method could be devised for diminishing the resistance of conductors, it would be a most important matter, as the enormous amount of copper at present required for any very large and widespread scheme of electrical distribution presents a very real difficulty.

It would be rash to deny too absolutely the possibility of the wireless transmission of electrical epergy in bulk. The fact that enormous quantities of energy come to us in this way from the sun, with a transmission density that near the sun's surface is immense, shows what the ether is capable of doing. Perhaps it may be found that though electromagnetic waves cannot be driven to go exactly and only where it is wished, they can possibly be led there. It is a problem at present beyond our ken, but so many marvels come to pass that one can never be sure of what may be brought about, provided always that no natural law stands in the way.

By far the most important requirement of mankind is energy in its various forms. Nearly all our energy comes to us directly from the sun, only a very small proportion of the whole is intercepted by the earth, but even so, the supply that the earth receives amounts to some 200 billion horse-power, or on the average to some 4,000,000 H.P. per square mile of that portion of the earth's surface that is exposed not too obliquely to the sun's rays. Sooner or later our coal will all be used up, and mankind will have to depend, no longer upon the stored energy of bygone aeons, but on the sun's actual daily supply. Unfortunately nothing better than the heat engine has hitherto been discovered to turn our coal and oil into mechanical work. Methods on the principle of Groves's gas battery, which gives electric energy directly from the oxidation of hydrogen, and others in which solid carbon is used as the oxidised element in a primary electric battery, were at one time considered hopeful, but have accomplished nothing. The thermopile has proved up to now a most ineffective appliance; has anyone, however, of late years investigated the thermo-electric properties of all the new metals that the electric furnace, and other novel metallurgical processes, have recently provided, and of the alloys that these will make, and does anyone know how thermo-junctions, made of these or of the older materials, whose properties we are acquainted with at ordinary temperatures, would behave at temperatures so low that all electrical resistance virtually disappears? Here are problems for the physicist and chemist which have great possibilities. Water power is insufficient to take the place of coal, while the power of the tides, which is enormous, would appear impossible to turn to practical use, except at a cost which is altogether prohibitive. The quantity of oil that appears to be obtainable is only a very small amount compared with coal.

When therefore the coal is exhausted it would seem that in the main recourse will have to be had to the enormous flood of solar radiant energy that is continually falling on the earth, and the problem is how this can best be utilised. The most obvious method is, of course, to grow plants, stimulating them in every way that science can devise; most likely it will be best to cultivate plants that store the solar energy in the form of starch and sugar which can be converted into alcohol.

As, however, vegetation is an exceedingly inefficient accumulator for the storage of solar energy, and as there is the further inefficiency of the heat engine to be taken into account before mechanical power can be realised, there arises the question whether science cannot devise some more efficient and different method of converting solar radiation into work. Solar engines have never so far proved commercially practicable, even where coal is exceedingly dear. Happily solar heat engines do not exhaust the possibilities of the case. The direct transformation of radiant energy into chemical, or even into electrical energy, is by no means impossible; Becquerel showed some 50 years ago how radiant energy could be transformed into electrical energy. There do not appear to be any theoretical objections to success, nor to much higher efficiencies being obtained in this way than by organic means. No doubt the laws of thermodynamics apply to all photo-chemical actions, but as the temperature of solar radiation is so very great this is of no large importance. Here then in photo-chemistry, perhaps in photo-electric chemistry, we have probably the most important problem that the science of the future has got to solve.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

18,889. "Electric heating elements for kindling." R. K. Hearn. November 18th.

18,891. "Electrical heating and cooking apparatus." C. G. Nobbs & W. W. Nobbs. November 18th.

18,892. "Dynamo-electric machines." N. C. F. Jensen & M. J. E. Tilney. November 18th.

18,895. "Direct-driven electric lighting apparatus for cycles, &c." C. F. Dufaux. November 18th. (France, November 16th, 1917.)

18,905. "Sparking plugs." D. Anderson & D. Daponte. November 18th.

18,908. "Electro-thermal arsenic refining and manufacturing furnace." H. J. Wilson. November 18th.

18,915. "Wireless signalling apparatus." A. A. Hall. November 18th.

18,916. "Electrically-heated strips or pads." W. H. F. Murdoch. November 19th.

18,928. "Electric switches." C. C. Garraid, A. H. Railing & A. F. Searle. November 19th.

18,934. "Magnetically-operated motor-controlling, &c., switches." J. H. Cowell & H. Cox. November 19th.

18,951. "Electric switches or circuit interrupters." British Westinghouse Electric & Manufacturing Co., W. A. Coates & W. B. Dale. November 19th.

18,955. "Automatic telephone systems." Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) November 19th.

18,957. "Electric dynamos." D. Suchostawer. November 19th.

18,958. "Method of producing electricity and mechanical power by permanent magneto." D. Suchostawer. November 19th.

18,979. "Electrical heating elements." A. W. Kimber. November 19th.

18,988. "Dynamo-electric machines." H. W. Denton-Ingham (A. Rolfe). November 19th.

19,000. "Dynamo." J. W. Ashton & J. H. Aston. November 19th.

19,005. "Shuttles for weaving in electrically-stopped looms." H. Jowett. November 20th.

19,015. "Device for electric illumination for theatrical and stage effects." T. H. Rochford. November 20th.

19,021. "Sparking plugs." H. R. Wilks. November 20th.

19,031. "Electrical transformers." J. W. Howard, L. D. Morphew and Siemens Bros. Dynamo Works, Ltd. November 20th.

19,037. "Driving magnetos for internal-combustion engines." J. Day. November 20th.

19,040. "Electric light fittings." J. A. L. Gimblette. November 20th.

19,058. "Switch-type incandescent lampholders." N. Collins. November 20th.

19,069. "Flashlamps." M. F. Williams. November 20th.

19,099. "Mounting electrical apparatus in frames or cases." H. B. Prentice. November 21st.

19,122. "Magnetos for internal-combustion engines." D. C. Dingley and G. Major. November 21st.

19,136. "Device for fixing and holding shades for incandescent and electric lamps." A. E. Fiddes-Sykes. November 21st.

19,145. "Names indexes for attachment to telephone instruments." J. L. Scott. November 21st.

19,146. "Alternating-current metallic air-cutting and welding apparatus." C. J. Holsgag. November 21st. (U.S.A., September 21st.)

19,147. "Electric arc welding and repairing." C. J. Holsgag. November 21st. (U.S.A., June 11th.)

19,150. "Electric relays." A. M. Low. November 21st.

19,152. "Signalling apparatus." A. M. Low. November 21st.

19,179. "Obtaining single-phase alternating currents of various periodicities from existing three-phase systems of any periodicity." A. M. Taylor. November 21st.

19,180. "Electrical rocket connections." H. J. Poole. November 21st.

19,193. "Method for recording visually signals received in wireless telegraphy." A. J. Gill. November 22nd.

19,194. "Relay contacts." N. P. Hinton. November 22nd.

19,195. "System of wireless direction finding." N. P. Hinton. November 22nd.

19,205. "Holder for use in electric arc welding." G. Dearle. November 22nd.

19,234. "Intercommunication telephone systems." J. W. Dungey & T. W. Wingfield. November 22nd.

19,247. "Electrically-propelled vehicles." F. V. Bornand & J. P. Kemp. November 22nd.

19,256. "Armature winding machine." L. E. Wood. November 22nd.

19,305. "Magnetos of internal-combustion engines, and driving provision therefor." R. S. Whaley. November 23rd.

19,311. "Electrical switches, starters, and controllers." R. H. Barbour and H. R. C. Partridge. November 23rd.

19,317. "Electric time switch." Landis & Gyr Akt. Ges. November 23rd. (Switzerland, December 18th, 1917.)

19,323. "Combined electric light fittings and ceiling fan." M. J. Railing & H. W. Roberts. November 23rd.

19,326. "Utilisation of wind power for generation of electricity." H. J. Read. November 23rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,982. Electrical switches. E. L. Rankin. July 30th, 1917. (Cognate application 17,311/17.) (120,222.)

11,038. Circuit-earthing devices. C. Longhi. July 31st, 1917. (120,224.)

13,070. Magneto-electric ignition apparatus for internal-combustion engines. M.L. Magneto Syndicate & C. E. Hulse. March 12th, 1918. (120,229.)

15,612. Cooling arrangements for dynamo-electric machines. P. A. H. Mossey, H. C. E. Jacoby & Enclosed Motor Co. October 26th, 1917. (120,241.)

15,730. High-tension distributors for the ignition in multi-cylinder internal-combustion engines. Akt. Ges. Brown, Boveri et Cie. November 6th, 1916. (111,659.)

15,970. Electric plug for steamship, factory, and general use. E. H. Kelley. November 2nd, 1917. (120,258.)

16,024. Telephone transmitters. S. G. Brown. November 2nd, 1917. (120,260.)

16,053. Electrical resistance elements. C. G. Nobbs & Falkirk Iron Co. November 3rd, 1917. (120,263.)

18,597. X-ray tubes. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 14th, 1917. (120,295.)

1918.

1,897. Engine-starting devices. A. E. White (Daton Engineering Laboratories Co., U.S.A.). February 1st, 1918. (120,312.)

2,573. Construction of ventilating fans for electric motors. W. F. Higgs. February 13th, 1918. (120,320.)

4,091. Electromagnetic brakes used on winding gears for haulage, lifts, and the like. Waygood-Otis, Ltd. (Otis Elevator Co., U.S.A.) March 8th, 1918. (120,330.)

6,068. Insulators for supporting electric cables. H. Wade (Soc. Metallurgica Italiana). April 9th, 1918. (120,336.)

7,550. Apparatus for correcting electric impulses, particularly applicable to automatic telephone systems. Automatic Telephone Manufacturing Co. & F. C. Tomlins (Automatic Electric Co. in part). May 0th, 1918. (120,175.)

7,629. Flexible conductors. Western Electric Co. (Western Electric Co., U.S.A.) May 7th, 1918. (119,832.)

8,901. Magnetos. Etablissements de Dion-Bouton Soc. Anon. May 31st, 1917. (116,290.)

9,056. Supporting means for electrical conductors. L. Joubert. June 4th, 1917. (116,889.)

9,836. Utilization of high-frequency oscillations in wireless installations. D. W. Brown. July 27th, 1917. (Divided application on 10,830/17.) (120,356.)

9,905. Ignition devices for water-cooled explosion motors. Motosacoche Soc. Anon. & A. Isliker. June 15th, 1918. (119,637.)

10,108. Automatic telephone exchange systems. Western Electric Co. (Western Electric Co., U.S.A.) June 19th, 1918. (119,839.)

10,806. Flywheel magneto devices for internal-combustion engines. Villiers Engineering Co., G. Funck & F. H. Farrer. July 2nd, 1918. (119,842.)

11,779. Trolley head for electric traction. W. Pickersgill, J. H. Pitt and F. Haigh. July 18th, 1918. (120,187.)

13,717. Electric adapters and the like. N. McLean. October 17th, 1917. (Addition to 112,240. Divided application on 15,040/17.) (120,023.)

Standardisation of Railway Plant.—A report upon the standardisation of railway equipment has been made to the Ministry of Reconstruction by the Advisory Council of the Ministry. The evidence taken showed that competition between the big railways had tended to progress on the whole, but had resulted in a quite unnecessary multiplication of types. On British railways there are two hundred different types of axle boxes; every railway company has adopted different types of tires, springs and axles; there are over 40 variations of the ordinary wagon hand-brake. In no other country has individuality been allowed so much free scope, with the result that British railways are severely handicapped and the working of them not so economical as it might be.

The Advisory Council recommends that the standardisation of wheels, axles, &c., be dealt with immediately by the Engineering Standards Committee, and that when such essential parts have been standardised, the adoption of the standards should be gradually enforced; that a committee be formed to investigate the existing conditions of structural gauges and clearances of the British railways and the loading and unloading arrangements at works and ports, in order to ascertain how far uniformity could be introduced and tares reduced, and at what cost; and that the consulting engineers and representatives of railways financed by British capital in foreign parts and in the Dominions be brought together to confer with the locomotive and wagon manufacturers in this country to determine what standardisation can be effected, and that, with a view to the possibility of effecting partial international standardisation, the separate committees should take cognisance of each other's investigations.—*Board of Trade Journal.*